

**A brief history  
of  
R Milton Johnson (RMJ)  
Milton Johnson and Associates (MJA)  
Milton Johnson and Partners (MJP)  
and  
MJ Consultants  
  
Consulting Engineers**

**1952-1985**

Version 1.6    14/05/2023

By John Woodside

## Contents

INTRODUCTION .....	3
BACKGROUND .....	9
RAYMOND MILTON JOHNSON 1925-2014 .....	10
Johnson Family History .....	10
The Early Years .....	11
Melbourne University .....	12
London 1948 .....	12
Return To Melbourne .....	12
Mussen, Mackay and Potter, Architects & Engineers.....	13
After World War 2 .....	14
Royal Australian Engineers (CMF).....	16
External Activities .....	17
Retirement.....	17
R MILTON JOHNSON (RMJ) .....	18
MILTON JOHNSON AND ASSOCIATES (MJA) .....	18
MILTON JOHNSON AND PARTNERS (MJP) .....	18
MJP CONSULTANTS and .....	18
MJ CONSULTANTS .....	18
Principal .....	19
R. Milton Johnson - BCE, SM (Harvard), FIE Aust, MICE, M.ASCE.....	19
Associates .....	20
Timothy J. Langley: BCE, AMIE Aust. ....	20
Donald W. Bentley - Dip. CE, MIE Aust.....	21
John H. M. Gellie - BCE, MIE Aust.....	22
Brian J. Whitehead - BE, MICE, MNZIE .....	22
John R. Hayes - BCE (Hons), DIC (Lond)., MIE Aust.....	23
Other staff members .....	23
Soilmach Pty Ltd .....	23
1952-1959 .....	24
1960-1966 .....	24
1967-1971 .....	33
1967 .....	33
1968 .....	39
1969 .....	42
1970 .....	44
1971 .....	48
1972-1985 .....	50
Norman Henry Mussen (1909-1967) .....	51

## INTRODUCTION

I was born in Griffith, New South Wales, in 1942. I attended Scotch College in Melbourne at the secondary school level from intermediate to matriculation from 1956 to 1959. Before that, because of isolation, I had received primary and the start of secondary school by correspondence in New South Wales. After matriculating at the end of 1960, I worked on the family farm for a year before I decided that I had missed an opportunity and went back and studied engineering for four years at Melbourne University from 1962 to 1965. I never went back to the land after that career change.

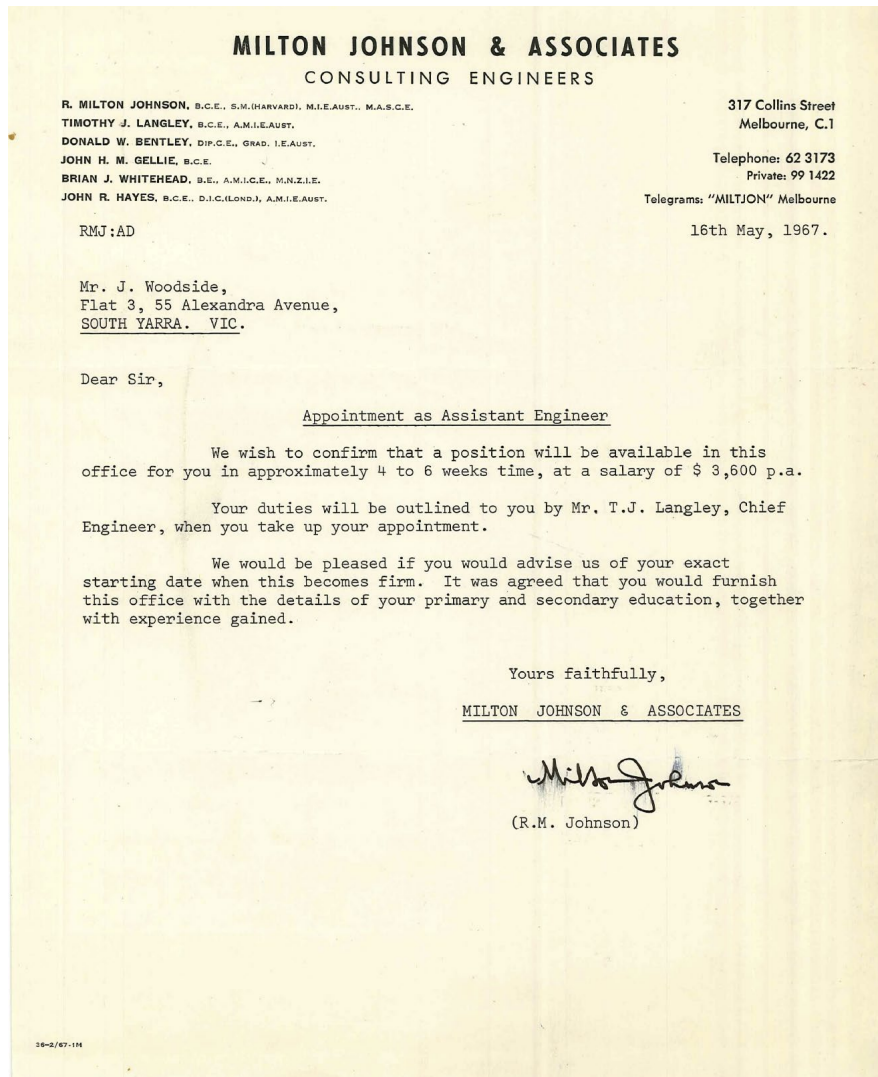
I was lucky enough to get a place in the men's residential college, Ormond College, at the University of Melbourne and completed my engineering degree in 1965.



**Ormond College, University of Melbourne**

I graduated in civil engineering in 1966 from Melbourne University, and then I completed a Master of Engineering Science in 1966-1967. I lived in a flat in South Yarra in 1966, and I was also a non-resident tutor in engineering at Ormond College. I was approached to become the resident tutor in engineering in 1967, and I lived in Ormond College from late 1967 until I went overseas in 1971. I was also briefly on the College Council as the tutor representative.

I was involved with Ormond College for about 10 years, and I have written separately about that time.



From July 1977 to October 1971, I worked in Melbourne for just over four years for the consulting engineering practice of Milton Johnson and Associates (MJA) and later Milton Johnson and Partners (MJP) on a variety of projects, including three bridges over the Tullamarine Freeway and various projects for the cement industry.

I was also heavily involved in Ormond Ski Club and building a ski lodge at Mount Hotham in Victoria in my spare time from 1969 to 1971<sup>1</sup>, and I have also written my own brief history of the initial building. I worked at the ski club for 110 days over three years. On reflection and over 50 years of experience in the building industry, we did not quite understand what we were taking on at that time, but youth and ignorance were on our side. We were also lucky that Lewis (Lou) Milne, father of George Milne, took the Ormond Ski Club under his wing and very much helped it in the construction phase. Lewis was a director of one of the largest building companies EA Watts in Melbourne at the time, and if it had not been for him, I do not think the venture would have been nearly as successful. He also arranged for the prefabrication and erection process on the site where the frames were erected, and the first-floor beams and roof beams were then bolted in between.

This era is what I called the years of my apprenticeship when I learned what engineering is about, as the university did not prepare me for the real world. I have to say, after 50 years of reflection on working in the building industry, I did not realise how little I knew, but we all learnt as we went along.

---

<sup>1</sup> Sarah Martin, *50 year history of the Ormond Ski Club, First Tracks to Last Drinks*, 2019



**Construction of the Ormond Ski Club 1969**  
**(Note the burnt snow gums from the 1939 Black Friday bushfire)**

I then travelled overseas and lived and worked in London for nearly three years, from late 1972 to mid-1975, working for the construction company Taylor Woodrow Construction Ltd. I first worked at their head office at 345 Ruislip Road, Southall in Middlesex, in early 1972 and then as a site engineer commencing late 1972 and then the senior site engineer (June 1973) on the Queen Anne's Mansions project in Westminster, London, from November 1972 until May 1975 for about 2<sup>1/2</sup> years. Again, I learned much about contracting and the other side of the construction fence.

On Monday, 27 November 1972, I started work again with Taylor Woodrow Construction Ltd for the salary of £2,700 Stg pa as the assistant senior engineer on the Queen Anne's Mansion site, at No 6 (later 102) Petty France, Westminster, London, just outside the St James Park Tube Station. It was a £12m project. Construction started in late 1971, with the existing building being demolished for the new Queen Anne's Mansions. It was also called Queen Anne's Mansions. The site was just outside the north entrance to the St James Park Tube Station. One could see Buckingham Palace clearly from the site, which was about half a kilometre away and which I drove past every morning to work. The funeral of Queen Elizabeth in September 2022 certainly brought back memories of that area which I got to know quite well at that time.

The new building was a conventional RC framed building with a 12 storey building and 16 storey tower and two basements for car parking, and a complicated external form clad in Portland Stone <sup>2</sup> (from

---

*2 Portland Stone is quarried from the Island of Portland in Dorset. The Island's stones are known to have been worked for nearly 1,000 years, originally on local projects: Rufus Castle 11th century, Exeter Cathedral 14th century and Portland Castle 1540s. From the early 1600s it started to become London's dominant stone, with Inigo Jones using it on Banqueting Hall, the stone having previously been used with success on elements of Westminster Abbey and the old gothic St Paul's Cathedral. Vast quantities of the stone went into London after the Great Fire of 1666 and up until this point the stone had come from the Landslips on the east coast of the Island. As demand continued into the eighteenth century, quarries opened up along the northern coast and during the*

which the name Portland Cement came to be known as it was similar in colour). It had reinforced concrete transfer beams, heavily reinforced.

So, what was my role on the site? I initially helped with the setting out of various parts of the building, and then I was responsible for about 8 site engineers when I became the senior site engineer on site. I was also responsible for temporary works design, including: -

- filling in the hole in the concrete slab for the crane in the basement in December 1972 between the tower building and the main building
- layouts for the concrete pours to the tower block in February 1973
- preparing formwork drawings for the shutters for the lifts in May 1973
- details of steelwork to support the stone platform in the tower in May 1973.
- steelwork to monorail framing for fixing of stonework September 1973.
- stonework platforms to the whole building in November 1973
- design of a rubbish hopper October 1973.
- repairs to the cantilever beam at the 4<sup>th</sup> floor in February 1974 as some of them were cast out of position.
- problems relating to the delivery of reinforcing steel because of the UK miners' strike in September 1974
- details of construction 11<sup>th</sup> floor around staircase 6, September 1974
- details of birdcage scaffolding 11<sup>th</sup> floor at staircase 6 October 1974
- tower block external scaffold to the plant rooms November 1974
- steelwork to support precast panels tower block January 1975.
- proposed precast for stair 5 February 1975.
- alternative fixing for pie crust stonework 3<sup>rd</sup> floor March 1975
- support of K units on the 11<sup>th</sup> floor East Wing April 1975

The site was adjacent to the Wellington Barracks<sup>3</sup>, the guards' home on duty guarding Buckingham Palace which feature extensively Queen Elizabeth funeral Charles III coronation. When I joined the site, construction of the basements was underway.

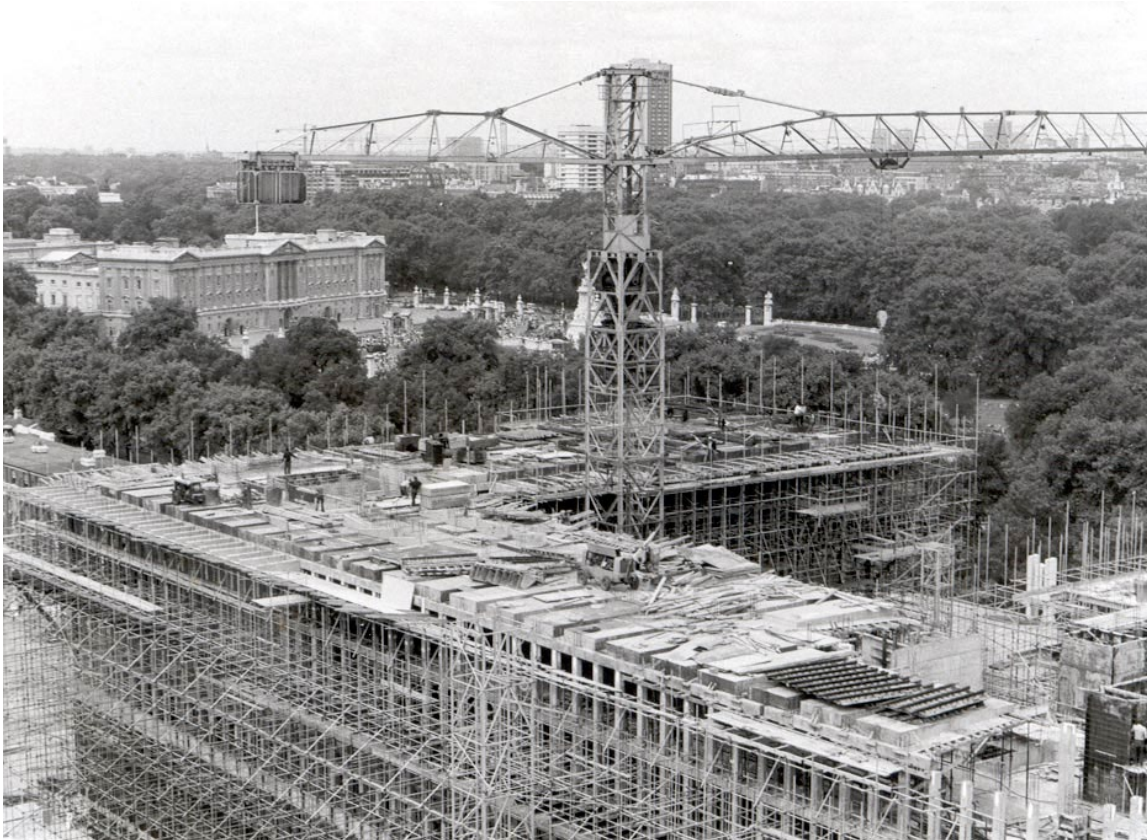
The site was previously occupied by the enormous 14-storey mansion block Queen Anne's Mansions, which some architectural commentators despised, and its demolition was regarded as highly desirable by advocates of modern architecture when Victorian architecture was not well-regarded. The original building was used by MI5. However, the new building was not favourably received architecturally either, due to its scale and massing with protruding elements at the upper and lower floors, often being described as a Brutalist design.

I also took the opportunity of embracing the history and culture of the UK while living in London and the arts, particularly opera and music. I went to Covent Garden, the Old Vic and other West End theatres and the Southbank regularly, sometimes more than once a week. I also travelled around the UK on a number of occasions and visited Europe several times.

---

*nineteenth and twentieth centuries in the centre of the Island. Despite these historically large volumes of stone leaving the Island for the construction of buildings in London and other major cities across Britain and the World, large reserves remain on the Island.*

*3 Wellington Barracks is a military barracks in Westminster, in central London, for the Foot Guards battalions on public duties in that area. The building is located about three hundred yards from Buckingham Palace, allowing the guard to be able to reach the palace very quickly in an emergency, and lies between Birdcage Walk and Petty France.*



**Construction of Queen Anne's Mansion with Buckingham Palace in the background  
c 1974**

On my return to Australia in mid-July 1975, I worked for about six months on the family farm "Boree Plain", about 25km south-west of Griffith in New South Wales, with my three brothers in a period of high inflation and political upheaval while the Whitlam Labor Government were in their final throes before being dismissed by Sir John Kerr. This allowed me to consider what I wanted to do with my future career.

On Friday, 19 December 1975, I was interviewed at about 2:30 pm by John Peyton and Ken (KG) Blight at John Connell and Associates offices, and I was offered a job possibly as a resident engineer. A letter offering me a job with JCA in Melbourne arrived on 24 December as a structural design engineer for JCA in Melbourne, which I subsequently accepted.

On 2 February 1976, I commenced work with John Connell and Associates (JCA) in Melbourne, later to be Connell Wagner (CW), and nearly 25 years later, I was finally to leave them, but I did not know at that time. My initial salary was \$14,750 pa plus overtime based on a 40 hour week. That salary was approximately \$100,000 in 2022 values or about double my starting salary about eight years previously. I worked in JCA's offices at 60 Albert Road, South Melbourne, where Aurecon operated until a few years ago. JCA decided that I should work in the design office for a year to catch up with metrication and the new codes, which had changed since I had been overseas.

Australia had converted to metric measurements in the early 1970s while I was overseas. I had to learn this new metric system as I always had worked in the imperial system of measurements and forces previously. The Australian Metric Board required that by 1975 all Australian Codes and Standards would be in metric, and all measurements would be in metric, and by the start of 1976, all building work had to be metric.<sup>4</sup>

---

<sup>4</sup> A major change during this period was the start of metrication in 1966, firstly changing the currency from pounds, shillings and pence to

I worked for John Peyton (JJP), Andrew Williams (AW) and Dr Jack Wynhoven (JHW), who had commenced work with JCA in 1972. Owen Martin sat behind me in those days, and Andrew Goad was on the Arts Centre site. Others in the Melbourne office included Malcolm Rose, who later died tragically at an early age in 1990, Geoff England, Gary Moreland, Neil Burnell, Sandy Bennett, Alan Chappel, etc. Owen Martin died in 2011 in Sydney from a brain tumour.

While in Melbourne, I had a four-month secondment to Kuwait from October 1976 to February 1977, discussed later. I then transferred to the Adelaide office of JCA in May 1977 in Adelaide and became an Associate on 1 July 1977. I worked in the JCA Darwin office from 1979 to 1981 as an Associate before returning to Adelaide, where I spent the rest of my career as a structural engineer. I have designed a wide range of commercial buildings, including 6 or 8 multi-storey buildings and various projects from small to large in a wide range of materials.

I became a Director of JCA Holdings Pty Ltd from 1983 until 1989 as part of the Connell Group when JCA ceased to exist, the company then became Connell Wagner, and then it merged with Macdonald Wagner in 1989. I then became a Director of Connell Wagner (SA) Pty Ltd until that company ceased in 1994, and Connell Wagner was reorganised into one overall company. I then became a Principal of Connell Wagner until I retired in 2000.

After my first retirement in 2000, I was asked to do some consulting work, so I set up a part-time consulting practice, J Woodside Consulting Pty Ltd, in 2001, consisting of myself only. I have provided engineering advice and limited design for the last 20 years on a part-time basis to a wide variety of clients. It has been a most interesting time, and while most of the projects are not large, they have been interesting and technically quite challenging and financially rewarding. However, I have reached my use-by date, and I intend to retire in 2023.

I have been involved in projects such as the restoration of the Sir William Goodman Bridge designed by John Monash (1908) in Adelaide, helping to write the concrete specification for the New Royal Adelaide Hospital and assisting a local precast concrete manufacturer SA Precast who makes all the new precast concrete for the Sydney Opera House to match the existing from about 2005 and other intricate projects. I have also got interested in heritage engineering and helping the Steel Reinforcement Institute of Australia write a *Guide to Historical Steel Reinforcement in Australia*. I have become skilled in the design and erection of what is now known as prefabricated concrete.

I have over 55 years of experience in the construction industry in Australia and overseas and widely experienced in many aspects of construction, including project management of projects, in the repairs and maintenance of buildings and heritage structures. I am also highly regarded for my experience in concrete and precast concrete.

In 2017, J Woodside Consulting, together with SA Precast, was awarded a WA State Award of Excellence by the Concrete Institute of Australia (CIA) for the Cadogan Song School in Perth. Subsequently, the Song School won the National Award of Excellence for Commercial Buildings and then the Kevin Cavanagh Trophy awarded by the Concrete Institute of Australia (CIA) at their Biennial Conference in Adelaide on 24 October 2017. The Kevin Cavanagh Trophy is the highest award awarded to a concrete project in Australia by the Concrete Institute of Australia (CIA) and is awarded biennially. The project was shortlisted by the Institution of Structural Engineers in the UK in the small projects section in their 2018 annual awards, which are international awards with projects from around the world being submitted.

---

*dollars and cents and the assent of the Metric Conversion Act in June 1970. Changes to measurement from imperial to metric started in 1971 and took several years to complete, with the building industry changing over by January 1976 and all new building started after that time had to be in designed and built metric units. As a result, all codes, standards and industry publications had to be revised into metric units by 1975. In some cases for manufacturers soft conversions were used until changes could be made into metric modules.*

In 2015, I was presented with an Engineering Heritage Australia Award of Merit by Engineers Australia for my contribution to heritage engineering and the restoration of the Sir William Goodman Bridge.

I was awarded the Lewis Kent Award in 2011 by the highly respected Institution of Structural Engineers from the UK for my outstanding contribution to structural engineering in Australia and the Institution of Structural Engineers.

In 2006, I was awarded the prestigious John Connell Gold Medal by the Structural College of Engineers Australia, which is the highest award they can make for an outstanding contribution to structural engineering and eminence in consulting engineering in Australia and overseas as a highly respected Principal of Connell Wagner. It stated that I had made a significant contribution to earthquake design and concrete design in Australia. I have had a passion for mentoring young engineers for a long time and have left an outstanding legacy for the future of the structural engineering profession.

I was also the Eminent Speaker for the Structural College of Engineers Australia and presented a lecture in 11 cities and towns in Australia titled *"The Art of Structural Engineering – An Australian Perspective"* in September and October 2007.

I was made an Honorary Member of the Concrete Institute of Australia (CIA) in 2005 for my services to concrete.

Since my initial retirement, I have written three family history books and become reasonably competent in writing histories of various subjects and timeframes, including this history which I have found quite fascinating. I have also written a record of my old firm John Connell Associates and Connell Wagner, my time at Ormond College and my involvement with the initial construction of the Ormond Ski Club from 1969 to 1971. The Internet is also an excellent source of information.

## BACKGROUND

This history has been compiled from a number of sources, including the following:-

- The tribute to Raymond Milton Johnson, which was prepared by his son Peter Johnson for his funeral in 2014
- My recollections of my 4¼ years as a graduate structural and civil engineer with MJA and MJP from 1967 until 1971
- Various documents which I have collected as part of that employment, including capability statements and similar documents
- Selected drawings prepared during that era which I have had scanned
- The MJA office manual No 22 I received in 1967, and I still have
- the Internet

If you become aware of any inconsistencies or errors, I would be grateful if you could let me know, and I'll be happy to correct them in the document.

To those who read this history, I hope you find it as interesting as I have found it in writing it.

John Woodside  
Adelaide 2023.

## RAYMOND MILTON JOHNSON 1925-2014

### Johnson Family History

These words were written for St Kilda Historical Society Inc. in 2005 on the Edgewater Towers at 12 Marine Parade, St Kilda by Peter Raymond Johnson and have been edited to suit.<sup>5</sup>

Some two hundred years, the Johnson family have for six generations been involved in the building industry: as a carpenter, builders, engineer, but no less than four as architects. Probably George Raymond Johnson (1840-1898) architect is the best known. I'm not aware of another such dynasty in Melbourne, although two generations in the one family does occur, one thinks of the Lewis's, Lyons's, Boyd's, Grounds's, Stoughton's three generations of McIntyres and the Bates, Smart and McCutcheon families within Bates Smart, Architects.

George was the son of William, journeyman (employee) carpenter and builder from Marston-on-Dove, Derbyshire. He was articled to George Hall, architect to the Midland Railway Co. He practised briefly in London before immigrating to Queensland in 1862. He worked as a surveyor and builder as Godfrey & Johnson (1863-64), then came to Melbourne in 1867. He was soon a successful architect here, designer of three groups of almshouses, including: the Jewish, at 619 St Kilda Road, St Kilda (1869, 47) and the Old Colonist Homes for George Coppin, the famous theatrical entrepreneur, at North Fitzroy (1870) and then fifteen theatres, including the Prince of Wales Opera House (1872), the Theatre Royal, Adelaide (1877), the Bijou, Bourke Street (1889), all now demolished and the Theatre Royal, Perth (1897) as well as many shops and hotels.

But George Johnson's greatest works are splendid town halls: Hotham (North Melbourne, 1875), Daylesford (1882), Maryborough (1887), Fitzroy (1887), Collingwood (1885-90), Northcote (1888-90) and Kilmore (1893-95), as well as the Metropolitan Meat Market (1879-80 & 89), the 1888 extensions to the Royal Exhibition Building and the Hospital for Incurables (the Austin, 1881). The only surviving building known to me he designed in St Kilda is the Daniel Tuomy house, owned by the artist Albert Tucker, later in his career, at 55 Blessington Street (9). George Johnson's practice collapsed in 1892, losing all his assets in the subsequent financial crash. He left Melbourne for Perth with his architect second son, Harry M.G. Johnson (1867-1931).

Harry's son, Harry Raymond Johnson (1892-1954), known as Ray, returned with his parents to Melbourne and settled in Middle Park. He was articled as an architect to his father, then began practice in Milton Street, Elwood, in 1915. During the 1920s, his practice blossomed, designing many country and suburban hotels, including the still-intact Waterside Hotel, 508 Flinders Street (1925). His project for the Egyptian Art Deco of Richmond Town Hall (1935) was controversial and his largest built project. Ray was elected councillor for the City of St Kilda, West Ward (1931-40) and became Mayor (1932-33). He probably effectively acted as an honorary architect for the major additions to the Town Hall (1939, 33). He designed houses at 94 Milton Street (1917) and 8 Broadway, Elwood (1919). From 1915-28, he designed houses in Milton, Ruskin, and Addison Streets, Elwood.

In 1920, Ray Johnson was the architect for Yurunga Flats, 36 Brighton Road, Balaclava, then for the conversion of 28-36 Alma Road, St Kilda (1925) into flats in a stripped, Mediterranean manner. Numerous blocks of flats in Elwood and St Kilda followed. Before World War II, these included Marlo Flats, 30 Mitford Street (c1929), the stylish Streamlined Moderne of Casa Milano, and 20 Grey Street, facing Jackson Street (c1933) and Oslo Guest House additions, 32-46 Grey Street (1936). Ray was also the designer for the Scoota Boat Building at Little Luna Park (1934), which I so enjoyed as a kid.

---

<sup>5</sup> <http://skhs.org.au/SKHShbuildings/43.htm>

After World War II, Mordecai Benshemesh joined Ray's office. Over the next four years, Benshemesh was responsible for the firm's design. They were very prolific. In 1946, the office produced two blocks of flats at 42 & 44 Southey Street, acting like sentinels on either side of Southey Court, and Rajon flats at 3 Tennyson Street. There are similar flats in Mitford Street, Barkly Street, Ormond Road and three blocks in Hotham Street near Cardigan Street. Their architectural style can be described as late Streamlined Moderne transitional to International Modernist. There are pressed cream bricks, corner steel-framed windows, the stair expressed as a vertical element, with full-height glazing and cantilevered round cornered balconies, with solid brick balustrades. The lines are very clean and planar, and the massing boldly expressed.

On Johnson's retirement in 1948, Benshemesh left to establish his own practice. His son, Raymond Milton Johnson (1925-), unable to enter the architecture course at Melbourne University due to its closure for the duration of World War II, became a structural engineer. He was the designer of many large aviation and brewing projects around Australia. He was also the designer of the alterations to the Victory Cinema in 1974 for its conversion and use by the National Theatre. Raymond Milton's son, Peter Raymond Johnson, was a practicing architect in St Kilda.

## **The Early Years**

Milton Raymond Johnson was born at the family home Alameda, 8 Broadway, Elwood, on 7 June 1925. His father, Ray, was an architect who came from a long line of builders and architects stretching back many generations. You might say that building was in his blood. So, it was natural to assume that he, too would one day be an architect.

However, fortune was to prove otherwise.

The Johnson family consisted of Milton's parents Ray & Margaret, his older sister Peggy, and his grandparents, Harry and Lily Johnson, who lived several doors away on Milton Street. This tight family group was further linked to his mother's family, the Cunninghams, who lived in Middle Park. This building in which the family gathered was the family's church, where all the great family events occurred – baptisms, confirmations, and marriages.

Milton started his education at Netley College in Mitford Street, eventually transferring to Melbourne Grammar in 1933. It was at Grammar that he met two significant friends, Jonnie Edwards, who became his constant swimming companion and Keith Dunstan, who he was later to share grandchildren with. And through his sister Peggy he met June Dyson. These three people and their subsequent families were to feature strongly in Milton's life.

As a child, he had many hobbies. They included building model aeroplanes, crystal sets, a Hornby model railway and, after the age of 11, photography. These were expensive hobbies. To finance them, he would enter various competitions then run for children. If you look online, you can see some of his prize-winning cartoons in the Argus. During the summer, he would do the rounds of the suburban beaches, competing in sandcastle building competitions. Invariably he won with a striking design.

Milton had an idyllic childhood growing up in St Kilda, engaging with his hobbies, swimming and cycling with Jonnie Edwards and visiting the Junction Oval with his father every other weekend to watch the St Kilda Football Club play their home games. Then there were the trips to the family beach house Ravenscourt at Mt Eliza, where his favourite activities included fishing with his father and horse riding with siblings Tony and Peg Robinson, who lived opposite.

## **Melbourne University**

By the time Milton had completed year 11 in 1942, the Architectural School at Melbourne University had virtually disappeared because of the war. So instead, Milton applied to do Engineering, and to his surprise, he got accepted! He was aged only 16.

Then on completing his course, he was offered a position in the Engineering Faculty as an assistant to the Professor of Civil Engineering. At the end of 1946, he travelled to Boston on a freighter to commence his master's degree at Harvard University in the newly developing science of Soil Mechanics.

## **London 1948**

By mid-1948, Milton had completed his engineering degree and was happily living in America. His parents, then staying in London for an extended break, became worried that Milton would never return home. So, Ray embarked on a plan to lure him away. He bought Milton a trans-Atlantic ticket on the Queen Mary. The bribe worked. Milton was so keen to accept that he missed his graduation by a mere 3 days!

And so, it was in London a short time later, at a dinner party given for his parents by Sylvia's elder sister Fleur Richmond that they met. Milton and Sylvia clicked immediately and were soon engaged and then sailing to Australia, courtesy of another ticketing inducement from Ray.

## **Return To Melbourne**

On 31st March 1949, he and Sylvia (Sylvonia Richmond) 1927-2017 were married at the Trinity College Chapel at the University of Melbourne.



**Milton Johnson as a young man**

Milton was again offered employment at the University of Melbourne Engineering Faculty, this time to set up the Soils Laboratory and to lecture on the subject.

In 1950 Milton joined the office of Mussen and Mackay, architects & engineers. One of the projects he worked on was designing a new power station for the Australian Pulp & Paper Mills Ltd, at the rear of 626 Heidelberg Road, Alphington.

Milton Johnson would have learnt a lot from Norman Mussen, a very competent and flamboyant structural engineer. Details of Norman Mussen's structural engineering career are at the end of this history. He would also have met Roy Grounds, and Milton was subsequently to work for this well-known architect.

## **Mussen, Mackay and Potter, Architects & Engineers**

The following words have been taken from Built Heritage Pty Ltd, "Norman Mussen", Dictionary of Unsung Architects, [www.builtheritage.com](http://www.builtheritage.com), with some minor editing and the use of those words is acknowledged.

The Melbourne architectural firm of Mussen, Mackay & Potter, which won considerable acclaim in the early 1950s with a succession of highly regarded projects, had an unusual mix amongst its three principals: architect E Keith Mackay (1903-1997) and engineers Norman Mussen (1909- 1967) and Charles Potter (1915-1999).

Initially, they formally entered into a partnership, styled as Mussen & Mackay, architects and civil engineers. Within a year or so, the firm's name had been amended to acknowledge the admission of two more partners: architect Dennis Mirams (1904-1984) and engineer Charles Potter. The former was an Englishman who had spent fifteen years in the Far East, and the latter was a returned serviceman from Melbourne who had served with the 3rd Australian Survey Battery. However, the expanded firm of Mussen, Mackay, Mirams & Potter existed only very briefly during 1951-52; when Mirams left to open his own office, the remaining three partners continued to practice under the abridged name.

Norman Mussen, well-known in pre-war Melbourne as a tennis and bridge player, was the son of Sir Gerald Mussen (1872-1960), a New Zealand-born journalist who, after settling in Melbourne in 1901, became a prominent industrial relations consultant. With the elder Mussen involved in large-scale planning projects at the mining towns of Port Pirie and Broken Hill, it is perhaps not surprising that his son chose to become a civil engineer. In 1936, Norman Mussen opened his own practice in Melbourne, with offices at 375 Collins Street, not far from his father's one in *Collins House* at No 360.

The younger Mussen's early professional experience included working as a consultant engineer to architects such as Eric Beedham and Marcus Barlow; he was involved in the latter's design for the eleven-storey concrete framed Century Building on Swanston Street. In 1940, soon after its completion, Mussen wrote to the editor of the Argus newspaper, arguing for the superiority of reinforced concrete over conventional steel framing and championing its use in defence projects. Fittingly, Mussen went on to act as consulting engineer to Percy Everett on the even more ambitious project for the new Russell Street Police Headquarters (1940-43).

During the war years, Mussen moved his practice to Collins House at 360 Collins Street, where his father still maintained his own offices. It was in this way that Mussen became involved in construction projects associated with Associated Pulp & Paper Mills Ltd, a consortium with which his father had been involved since its foundation in 1936. Requiring the additional input of an architect, Mussen invited Keith Mackay to work with him, and in 1946, the two men merged their offices with a single address at 383 Latrobe Street. In 1950, they formally entered into a partnership, styled as Mussen & Mackay, architects and civil engineers.

During its earliest years, Mussen, Mackay & Potter maintained an informal association with the private

practice of Roy Grounds (1905-1981), who, in his capacity as senior design tutor in the School of Architecture at Melbourne University, had invited Mussen to lecture in structural engineering in 1950.

This association spilled into their respective private practices, and, in some contemporary sources, the firm of Mussen, Mackay & Potter was co-credited on two of Grounds' most important early post-war houses: the triangular Leyser House in Kew (1950-51) and the Ashton House in Mornington (1951-52).

Norman moved to Canberra in 1953, and probably, as a result, Milton Johnson decided to set up his own engineering consulting practice in Melbourne.

Further words are provided on Norman Mussen and his contribution to structural engineering at the end of this document.



**Milton and his sister Peggy in Melbourne circa the 1950s**

## **After World War 2**

Milton Johnson would have set up his firm just as Australia was coming out of the effects of the Second World War and the previous depression. There was a period of prosperity over a number of years as companies expanded and built new facilities in Australia. There was also a significant shortage of electricity requiring new power stations.

Up until about 1955, there was a shortage of most building materials in Australia. Until 1958, buildings had to be less than 132 feet (40 m), being the highest that fire ladders could reach. In 1958, Melbourne's first skyscraper was built, the 19 storey ICI building on Nicholson Street, East Melbourne, with the

structural design by JCA and it was built by EA Watts. From November 1958 to 1961, it was the tallest building in Australia. As a result, the market shifted to building taller buildings in this period.

Another issue with the building industry was the difficulty in getting structural steel, and together with the large migrant intake after the Second World War, the skills for concrete structures rapidly increased, and concrete replaced steel for many multi-storey buildings and has dominated the market since that time.

There were no computers until about the 1960s, and even then, these were mainframe computers owned by large computer companies or some government departments or universities. They generally used printed cards and card readers and had limited application for engineering design at this time. For some larger projects, some limited form of computer analysis may have been carried out.

The design of the mainframes for the Northern Grandstand for the MCG used some elementary computer analysis by Milton Johnson and Associates (MJA). The Reinforced Concrete Design Handbook, published in 1968, used CSIRO for the programming of the design formulas for the preparation of the design tables in the handbook.

All concrete design in this era was based on imperial units, and reinforcement was mild steel round bars with 36,000 psi yield strength (Grade 250) until 1958. Engineers were still using slide rules, and all computations were prepared by hand on foolscap paper. In 1958, the second edition of Concrete Code AS CA 2 was published. Also, this year Australia Standards A81-84 and A92 were published for Steel Reinforcing Materials for Normal Reinforced Concrete. Between 1958 and 1963, three new types of reinforcing bars were introduced to the Australian market being square twisted bar (ST), deformed bar (DB) and CW60 bar (CW or C) because of these new standards for steel reinforcing materials. The first of the changes to reinforcement in this era was the introduction of a square twisted bar in 1958 by ARC. In this process, a square bar was twisted to provide the yield strength of 60,000 psi, Grade 414 (usually taken as Grade 410). This bar was only produced for a relatively brief period and was replaced by the cold worked deformed round bar known as CW bar in 1963 of the same strength.

Concrete strengths in this era were in the range of 2,000 to 5,000 psi, i.e., 13.8 MPa to 34.5 MPa and admixtures were largely unknown until the 1960s. Concrete strengths could be as high as 6,000 psi (41.4 MPa), but typical concrete strengths in the range of 2,500 to 3,000 psi were used for most projects.

There were some existing consulting firms in Melbourne in this era, including Guthridge Haskins and Davey (GHD), Mussen & McKay, as noted above, and Cyril Hudspeth and Associates (later to become JCA)

New consulting firms were also to appear in this era, including Milton Johnson and Associates in Melbourne in 1953, Rankine and Hill in 1955 in Sydney, Miller, Milston and Ferris in 1957 in Sydney, John Connell and Associates (JCA) in 1958 in Melbourne, TTW (Taylor Thompson and Whitting) was established by three entrepreneurial engineers: Dick Taylor, Jock Thomson, and Alan Whitting in 1958 in Sydney. In 1960 Malcolm Kinnaird in Adelaide, who had just graduated with Don Hill, Howard Young and Maurice de Rohan, founded the consulting engineering firm of Kinhill, de Rohan and Young, then Kinhill Pty Ltd and later Kellogg Brown and Root (KBR) acquired the firm in 1997. Ove Arup and partners came to Australia in 1963 to undertake the structural design of the Sydney Opera House.

The other change to construction in this era was the vast improvement in craneage. This change in craneage was not limited to fixed craneage but also included mobile craneage. The self-erecting tower Favco crane was invented by Eric Favelle in 1962. The design allows the crane to increase its own height as the construction proceeds upwards and rapidly became the favoured crane on multi-storey buildings. They could lift between typically 8 and 12 tons, depending on the location of the crane and the reeving of the lifting hook. Also, mobile craneage improved dramatically from the 1960s onwards. Another soft revolution in the construction industry at about this time was the introduction of concrete

pumps in the late 1960s, and by the mid-1970s, most concrete on larger projects was delivered by pumping concrete.

With the improvements in craneage both in the factory and on site, there was a substantial shift to using precast concrete for external walls for multi-storey buildings, being either loadbearing or non-loadbearing clip-on panels. In the 1960s and 1970s, precast cladding panels replaced brick infill panel walls, as this gave architects considerable freedom of choice in colours and shapes, which were not available in brickwork. Unfortunately, often with such advances in technology, a lack of understanding of the behaviour of the structure behind and the durability of the precast cladding elements resulted in some failures. These failures included axial shortening resulting in additional compressive stresses in the precast panels, failure of connections with local corrosion due to water getting into the joints, the breakdown of veneered layers where these were incorrectly poured, spalling and corrosion of reinforcement due to lack of cover and poor workmanship.

Construction on the Sydney Opera House started in May 1957, and in 1963 Ove Arup and Partners began calculations for the roof structure which is made from precast concrete to provide the famous sails. Concrete Industries Monier developed the opera house surface finish for Utzon for the precast concrete and treated it as a trade secret. However, EPM Concrete Pty Ltd won the tender in 1966 for the Sydney Opera House, then being a member of the ARC Group of Companies, and they supplied 10 acres (4 ha) (436,000 ft<sup>2</sup>) of acid etched reconstructed granite wall panels and paving slabs to this project. Most of these panels were veneer construction and used bronze fixings for fixing the precast elements. Ove Arup and Partners were the consulting engineers. The author has worked on new precast concrete to match the existing for the Sydney Opera House since about 2005 and is often involved in 2 or 3 small projects a year.

## Royal Australian Engineers (CMF)

Milton Johnson had a very strong sense of duty. As he had missed out on military service during the war due to his age and university studies, he was determined to make up for it on his return. So, in 1949 he joined the Royal Australian Engineers (Army Reserve). It turned out to be a very 'smart move' as the group of engineers he met there became the basis for much of his future client network, the most significant of whom were John Holland, Bill Harker, and Geoff Cook<sup>6</sup> (the John Holland Group).

---

### *6 Geoffrey Page COOK Company Manager*

*Geoffrey was born in Melbourne in 1928, the son of Lt-Col (later Brigadier) Thomas Page Cook, who had commanded the establishment and provisioning of the Tobruk garrison in a remarkable time. In March 1941 his father completed a famous 'appreciation' on the problem of defending Tobruk. Geoffrey would occasionally bring this wonderful document to business strategy and planning meetings, to show others what a proper 'SWOT Analysis' can achieve.*

*After secondary education at Scotch College in Melbourne, Geoffrey completed his Bachelor of Civil Engineering in 1949. Showing early the ability to succeed in many disciplines, he served articles and qualified as a Licensed Surveyor, winning the 1951 Institution of Surveyors prize.*

*He travelled and worked briefly for Dowsett Engineering in northern Australia before joining John Holland (Constructions) Pty Ltd in 1955. He was the Project Manager for the Sorell Causeway Bridge in Tasmania, completed in 1957. This bridge featured the use of both prestressed, precast piles and precast, post-tensioned bridge girders; the first known applications of these techniques in Australia. The bridge was replaced in 2001 because of chloride ingress.*

*Geoffrey led teams of engineers who set new standards in integrating engineering design and construction technologies for a wide range of major bridge, marine, power generation, mining, water supply and structural projects throughout Australasia. Widely recognised as one of Australia's pre-eminent bridge construction engineers and a specialist in the field of prestressed concrete, he ascended to the role of Managing Director of John Holland Constructions. He was one of the original subscribers to the Concrete Institute of Australia on 17 April 1970.*

*As Chief Executive of John Holland Holdings Limited between 1978 and 1986, he maintained and further developed the reputation of the company as being one of the most successful and reputable groups in the construction industry. He was the President of the Australian Federation of Construction Contractors and participated in many peak industry bodies.*

*Following a takeover of John Holland in 1986, Geoffrey embarked upon what would ultimately be a significant new career as a non-executive director and achieved notable success. He was Chairman of the State Electricity Commission of Victoria between 1987 and 1990, thus responsible for providing leadership for one of Australia's largest and most important statutory bodies.*

*Between 1987 and 1991 he was Chairman of the Snowy Mountains Engineering Corporation and Deputy Chairman of the Overseas Projects Corporation of Victoria. Throughout the 1990's he sat on the Boards of notable new start-up companies in the infrastructure sector, such as Transurban Limited, Pacific Hydro and the owners of privatised power assets in the La Trobe Valley.*

*Geoffrey's skills in corporate governance also enabled him to have many key roles in the successful development of the superannuation sector in Australia. He was Chairman of what is now the Telstra superannuation fund, a director of SECV Superannuation and was an early employer nominee on the boards of the new construction industry fund entities BUS Pty Ltd (now CBus) and AUST Pty Ltd.*

They soon became very close friends and later provided Milton with a constant stream of work as he established his practice. Geoff Cook ultimately became managing director of John Holland until 1986, and after that, he had a very distinguished career in the corporate area.

In 1959 Milton joined a group of Royal Australian Engineers on an exchange visit to Hawaii with the US Army. In 1962 he retired with the rank of Major.

## External Activities

Outside the office, Milton Johnson was also very busy. The list is prodigious, and he was involved in the following:-

- Lecturer in Professional Practice at both Monash and Melbourne Universities Engineering schools
- Lecturer in Soil Mechanics at the Architecture Faculty, University of Melbourne
- Member of the Engineering Faculty Board, Monash University, 1968-75
- Chairman, Association of Consulting Engineers, Victorian Division, 1975-77
- Chairman of the institution of Civil Engineers, Victorian Division, 1979-80
- Two State Government inquiries that he also served on:
  - The Inquiry into the retention of the CBA Banking Chamber, 1973
  - The Inquiry into the retention of the Regent Theatre, 1975

## Retirement

In 1979 Milton retired from active practice, aged only 54. Ten years later, he sold his company Soilmech.

---

*He also made outstanding contributions in a number of areas of community and public service, as a Director of the Victorian State Opera and as National President of the YMCA from 1985 to 1988.*

*The many honours bestowed upon him included Fellowship of the Australian Academy of Technological Sciences and Engineering, and in 1990 he was installed as a Member of the Order of Australia for his services to the community and the construction industry. In 1992 he was presented with the University of Melbourne's Kernot Memorial Medal, in recognition of his distinguished engineering achievement. In 2004 he was awarded a Centenary Medal for service to Australian society in power engineering.*

**R MILTON JOHNSON (RMJ)**  
**MILTON JOHNSON AND ASSOCIATES (MJA)**  
**MILTON JOHNSON AND PARTNERS (MJP)**  
**MJP CONSULTANTS and**  
**MJ CONSULTANTS**

Milton Johnson commenced practice as a consulting engineer in 1952 as R Milton Johnson (RMJ) with just a small number of projects, but these quickly grew until, by the late 1960s, he had the second largest consulting engineering practice in Melbourne with about 80 staff. In the early 1960s, the firm became Milton Johnson and Associates (MJA). A recession in 1969 led to a reduction in staff, and by about 1971, they had about 30 staff in all. In about 1970/1971, the firm became known as Milton Johnson and Partners (MJP).

Since its founding in 1952, it provided a wide range of services to many architects and authorities through its three divisions, namely:-

- Structural
- Civil Engineering
- Foundation Investigation

Each division was equipped to handle design, contract documents and supervision. Engineers use the latest planning methods, e.g., PERT/CPM, in their approach to project design and pride themselves on producing economic solutions to the client's requirements on time.

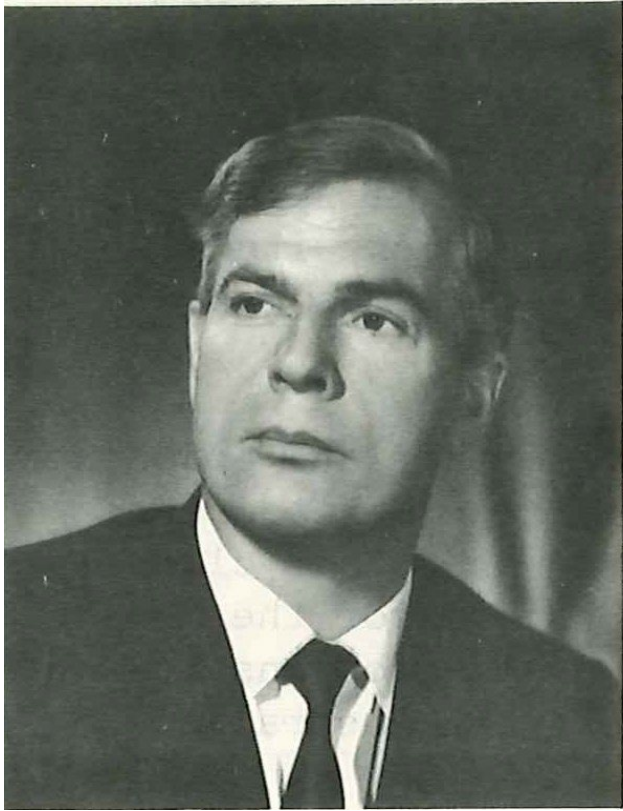
Their project sites were all over Australia & New Guinea and included:

- Breweries for Carlton United Breweries Ltd
- Aircraft facilities for Ansett Airways
- Power stations at Calcap & Collinsville for the Queensland Electricity Corporation
- Cement works for the Australian Portland Cement Company
- The list of projects was extensive.

Probably the job that Milton Johnson was most proud of was the National Gallery of Victoria, for which he designed the extensive piled substructure and the hydraulics, which included the front entrance 'water-wall', the water jets in the courtyards, the water swells in the moat, and the vast rainwater storage tanks in the basement that provided water for the moat. In more recent times, he would often say in his typical dry style, *"I don't know what those 'greenies' are making a fuss about, we were doing water recycling back in the 1960s!"*

The Performing Arts Centre was also a memorable job for other reasons. This was because, after extensive investigations and thorough analysis of the tricky sub-ground conditions, his and Ken Chandler's advice was rejected. The architect Roy Grounds opted for a less expensive solution that ultimately failed, leading to a multi-million dollar lawsuit against all the consultants involved, lodged by the affected adjoining property owners.

No task was too difficult, too large, or complex to solve. He and his courageous team of engineers always found a simple and elegant solution.



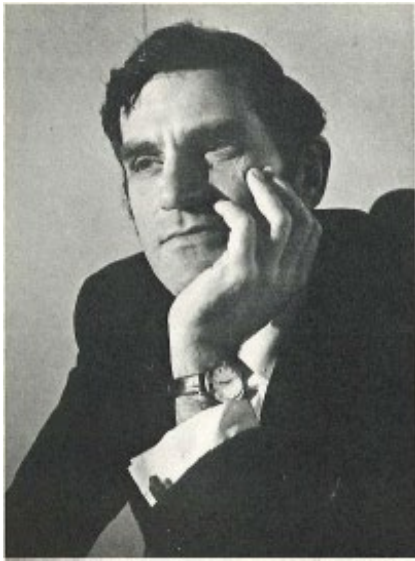
## Principal

### **R. Milton Johnson - BCE, SM (Harvard), FIE Aust, MICE, M.ASCE**

Born in Melbourne in 1925, he graduated Bachelor of Civil Engineering from Melbourne University in 1946; also, a Master of Engineering Science at Harvard University in 1948, where he was a teaching fellow. He graduated with a Master of Science in Civil Engineering after a postgraduate course in soil mechanics and foundation engineering.

After a period of practical experience in the UK, he lectured at the University of Melbourne for 12 months and was responsible for the initial development of their soil laboratory. After about three years of experience with consulting architectural and engineering firm of Mussen McKay, he founded his own consulting engineering practice, R Milton Johnson Consulting Engineer, in 1952. This then became known as Milton Johnson and Partners (MJA) in the early 1960s, and by the early 1970s, Milton Johnson and Partners (MJP). His role was to actively develop and direct all departments and to investigate new technical services that were required by industry.

## Associates



### **Timothy J. Langley: BCE, AMIE Aust.**

#### **ASSOCIATE AND CHIEF ENGINEER**

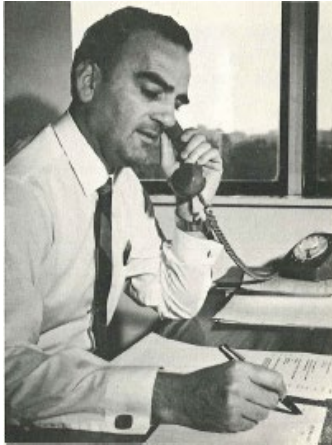
Tim graduated from the University of Melbourne in 1952. His first experience was structural design with Victorian Railways for twelve months, and then two years of experience in the United Kingdom on civil engineering contracting and soil mechanics with John Mowlem and Soil Mechanics Ltd.

Tim was the project engineer on the design of the civil and building works for Calcap Stages 1 and 2 and Collinsville Stage I, including the detailed design of the structural steelwork.

Tim joined the practice in 1956 as and subsequently became the Chief Engineer. He was responsible for:-

- The technical excellence of all design work,
- Contract supervisory procedures,
- Work allocation and staffing of project teams.
- Staff training.

Tim subsequently joined Connell Wagner working in Melbourne and Darwin before he retired to Brisbane in 1996.



### **Donald W. Bentley - Dip. CE, MIE Aust**

#### **ASSOCIATE AND EXECUTIVE ENGINEER**

Don graduated from RMIT in 1953 and joined the practice in 1955. Don spent 10 years on structural steel design and fabrication with the firm Vickers Ruwolt Pty Ltd,<sup>7</sup> where he was the senior project supervisor. Vickers Ruwolt provided a lot of equipment for the cement industry in Australia.

He joined the firm in 1955 and carried out the development, planning and detailing of many new projects as well as the alteration and extension of existing industrial establishments.

He was responsible for the supervision and contract administration of a number of projects associated with Ansett-ANA at many airports throughout the Commonwealth and New Guinea. Don has special knowledge of the problems associated with construction in tropical climates.

An overseas tour of Japan enabled him to study the latest prestressed and reinforced concrete technology in that country and evaluate their relevance to Australian conditions.

---

<sup>7</sup> In 1902 the German-born and Australian educated engineer, Charles Ernest Ruwolt (1873-1946), opened an iron foundry and engineering works in Wangaratta for the purpose of manufacturing windmills and carrying out agricultural machinery repairs. By 1906, Ruwolt had diversified into repair work on bucket dredges and other gold mining equipment employed in the Ovens Valley, employing a workforce of 20 to 30. In 1908 Ruwolt merged his business with an engineering workshop in Bright owned by Isaac Stevenson, an experienced dredge engineer from New Zealand, and they commenced manufacturing complete gold and tin mining dredges. The firm was at this time registered under the title Charles Ruwolt Pty Ltd, with a working capital of £25,000, with Ruwolt and Stevenson as the principal shareholders.

In 1911, partially in response to a growing export demand for large tin mining dredges, Charles Ruwolt acquired a 10-acre site previously used for market gardens on the banks of the Yarra River in the Melbourne suburb of Richmond, with a view to relocating the company's manufacturing operations.

Construction of engineering workshops, company offices and an iron and steel foundry commenced on the Richmond site in January 1912 and over the following few years all the firm's activities were progressively relocated to Richmond. By 1914, the registered office of Charles Ruwolt Pty Ltd had moved to Victoria Street, Richmond.

In November 1920, the firm was reorganised as a public company under the title Charles Ruwolt Proprietary Company Ltd. with a nominal capital £250,000, with additional shareholdings taken up by two long-term employees Mr Arthur Irwin Beard and Mr Ellis H. Davies, and the founder's son Rupert Ruwolt, who also became directors. By 1922, the firm had begun diversifying into heavy industrial work, producing road-making equipment, ore crushing machinery for the mining industry, brewing machinery, and hydraulic presses for the emerging Australian car industry. By 1938, Ruwolt was one of the largest engineering companies in Australia, occupying 20 acres (8 hectares) and employing 600-700 workers. With the advent of the Second World War, the firm was deployed to manufacture field artillery and Charles Ruwolt held a senior position in the wartime administration of home-front resources.

Charles Ruwolt died in 1946 and by 1948 Vickers Limited (UK) had purchased the business, which then became Vickers Ruwolt Pty Limited. Later, Hoskins and HADWA, both companies in Perth, were purchased and a new public company, Vickers Australia Limited was formed. Vickers Ruwolt, a Division of Vickers Australia Limited, was over one-third owned by the Australian public and employed about 4,000 people around Australia. Between 1982 and 1983, the HADWA steel foundry in Perth and the Ruwolt steel foundry in Richmond were closed, and in 1985 it was decided to close the Ruwolt facility and move the heavy fabrication, machine, and fitting factories to Karrabin, Queensland.



**John H. M. Gellie - BCE, MIE Aust.**

**ASSOCIATE**

John was born on 8 December 1933 and educated at Wesley College, and attended Queens College, including later being on the College Council. He graduated from the University of Melbourne in 1957. His early civil engineering construction experience at Kiewa and Yallourn was followed by civil and structural engineering design.

He joined the office in 1963 and subsequently was responsible for the structural design of the concrete elements for the Collinsville Power Station, major projects for Carlton & United Breweries Ltd, and other organisations involved in medium and heavy industry.

Other projects have included the direction of a design team on an aircraft jet engine test cell, structural work for the Julius Marlow project, and the design review of structural computations for the Bougainville Copper project.



**Brian J. Whitehead - BE, MICE, MNZIE**

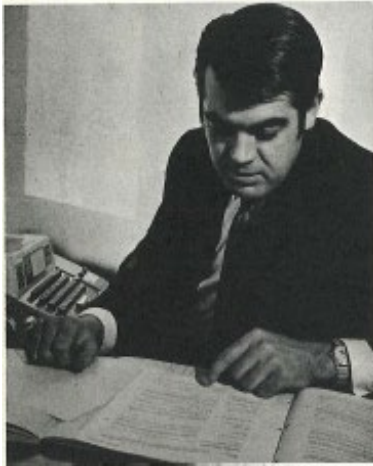
**ASSOCIATE**

After graduating from Canterbury University New Zealand in 1954, he gained a wide variety of

experience with local bodies, contractors, and consultants in NZ for three years on municipal work and power station construction. Then he worked overseas for a further three years in Nigeria with Ove Arup and Partners in London on a large civil engineering project.

He joined the office in 1962 as a Project Engineer; he was responsible for many jobs, including the initial stages of the Arts Centre, the new Western Stand at the MCG and a number of Hangar and Maintenance Base developments for Boeing hangars at Sydney and Melbourne. He also worked on the completion of the beer storage cellar and the new Western Stand at the MCG.

He was the Honorary Secretary of the Institution of Civil Engineers, Victorian Local Association.



### **John R. Hayes - BCE (Hons), DIC (Lond)., MIE Aust**

#### **ASSOCIATE**

John was born on 22 February 1936 and was educated at Melbourne Grammar School, and attended Trinity College, where he played football. He graduated from the University of Melbourne in 1957 and joined the firm in 1964 after experience overseas in England, Holland, and Nigeria with Shell Petroleum.

Major projects for which he has been responsible include "turnkey" contracts at cement plants at Geelong, Townsville and Tasmania and the design of prestressed concrete and steel bridges for the Tullamarine Freeway in Melbourne.

He specialised in the planning and control of multi-discipline projects, combining civil, mechanical and electrical engineering, and directed the firm's Computer Section.

### **Other staff members**

I do not have a complete list, but they included persons such as R Story, KJ Gaillyard, SR Kruspe, who was an architect, JP Pendavich, CE Knowles, DC Ebbs, MJ Corbett, GL Dibbin, R Trembath, F Coppinger, Frank X Pearce and Bill Ramsey. I can only really remember the senior people and the odd ones who I got to know during my short time there.

### **Soilmech Pty Ltd**

In 1959 Milton split the riskier Geotechnical Services from the consulting practice and formed a separate company called Soilmech Pty Ltd, led by the engineer Ken Chandler as its manager. Its offices were at 31 Cremorne Street in Richmond, telephone number 42 1831. The firm, in the early 1970s, carried out about 50% of site investigations for city buildings in Melbourne.

## 1952-1959

Presumably, Milton Johnson was the first employee of R Milton Johnson, Consulting Engineers (RMJ), and he probably had a drafter and part-time secretarial staff. Until about 1958, the practice was operating as R Milton Johnson, Consulting Engineers at 317 Collins Street, Melbourne.

According to the office manual, the first job for R Milton Johnson as a consulting engineer was in 1953 for Carlton and United Breweries (CUB). The office continued to get a series of projects from the brewery over the years.

Because of his experience and background in architecture, for many of the projects the firm was involved with, they often designed the architectural, structural and civil engineering aspects of the project, particularly on the many industrial projects they were involved in. They usually acted as a prime consultant and rarely used an architect, and they had an architect on their office staff.

In 1952 possibly the first prestressed concrete building in Australia was the Ice Tower used for the construction of the Warragamba Dam in New South Wales due to shortages of reinforcing materials. The tower was 10 m x 12 m and 30 m high, and the frame consisted of precast beams and columns post-tensioned together after erection. Miles Lewis, however, suggests that the first use of prestressing in Australia was at a Queensland University building in the same year.

In 1955 RMJ designed the Sorell Causeway No 1 Bridge in Tasmania for John Holland, and they also assisted in the moulds for the deck beams. It was one of Australia's first post-tensioned beam and slab bridges and was constructed in 1956 in a maritime environment northeast of Hobart, Tasmania. The bridge was 457 m in length with 34 spans, each of about 13 m consisting of 14 precast posttensioned T beams. It was the longest prestressed concrete bridge in Australia when constructed, and it was opened in 1957. Milton Johnson modified the original PWD superstructure for John Holland's, and Humes made the 476 concrete beams using the Freycinet prestressing system. A feature of this bridge is that the voids for the tendons were created using inflated rubber tubes which were withdrawn after the concrete had hardened. Unfortunately, the cover to the reinforcement was only 25 mm, and calcium chloride was used as an additive to the concrete to aid early setting, which was common in that day but now is not permitted because of chloride corrosion. As a result, the bridge suffered severe corrosion, and was demolished in 2001 and replaced with a new bridge.

Other projects for John Holland in this era included a road at Cairn Curran Dam, a bridge over Wallamba River in New South Wales, Macquarie wharf No 2 berth, Hobart, Portland bulk store for HC Sleigh, the Turbine E at Yallourn Power Station for the SEC.

Don Bentley joined the firm as an engineer in 1955, and Tim Langley joined the firm in 1956 as a project engineer.

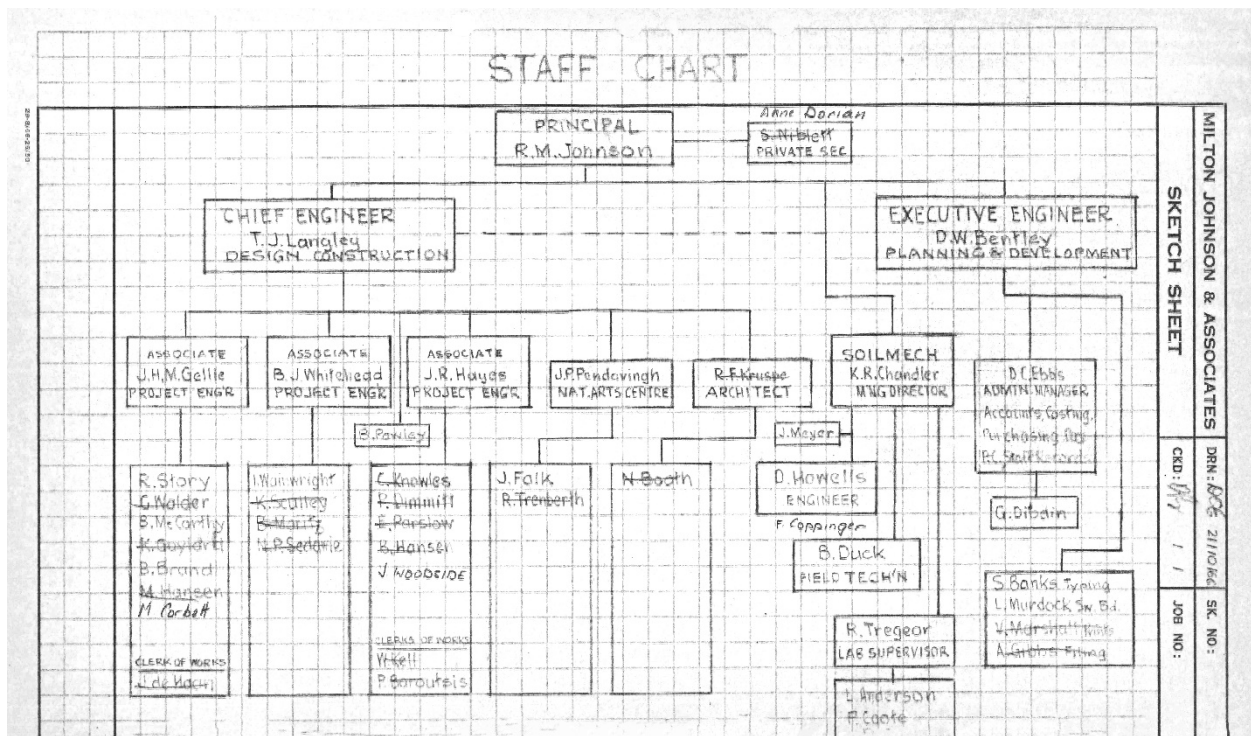
As noted above, Soilmech was split from the firm in 1959 and became a separate firm.

## 1960-1966

By the end of 1966, the firm had approximately 45 staff. In this period, they designed a wide range of projects, including civil and structural engineering, as shown in the chart below.

Sometime in this era, probably in the mid-1960s, the firm changed its name to Milton Johnson and Associates (MJA). Presumably, the Associates had some share in the business and the profits it made, but I am not aware of the financial details or ownership.

In 1962 Brian Whitehead joined the firm, followed by John Gellie in 1963 and by John Hayes in 1964.



**Staff chart 1966**

In the years 1963/67, the office designed all the civil works for two Queensland Power Stations. This work has been performed in their capacity of civil consultants to John Holland & Co. Pty. Ltd., The Engineer Constructor to the Capricornia Regional Electricity Board and the Northern Electric Authority of Queensland.

The Calcap Power Station<sup>8</sup> (Callide A) is situated on the Callide Coalfields within 100 miles of Rockhampton with pulverized coal fired boilers, ancillary plant, buildings and an administration block. The first unit was placed in operation in June 1965. The value of work designed by the office was of the order of \$2,300,000 and included:

- 40,000 cu, yds. excavation
- 70,000 cu, yds, filling
- 11,000 cu, yds, concrete
- 5,000 tons of structural steelwork.

Major design components were:

- Site Investigation and earthworks
- All plant and building foundations
- Structural/and architectural content of turbine house, annexe, and administration block,
- Cooling tower ponds, 1 million gallon reservoir, 16" dia water supply pipeline from Callide Dam, 2½ miles in length,

<sup>8</sup> At the end of 1962 approval was granted for a new power station near Biloela. <sup>1</sup> Work commenced at the site in February 1963. The design of the plant based around separate generating units and a control room was a first for Queensland. <sup>2</sup> It was also the first power station in Queensland to use dry cooling towers. It had four 30 MW steam turbines, the first of which was operating by June 1965. From its commissioning a drought meant water restrictions at the station reduced output. The second set was expected to be operating by May 1966, but was lost at sea while being transported from England. <sup>3</sup> A replacement unit arrived in June 1967. The third set was operating in October 1967 and the fourth in May 1969. <sup>4</sup> The total cost of the project was A\$28.7 million. Callide A has been in storage since 2001, except for Unit 4 which was being used for the Callide Oxyfuel Project.

- Switchyard foundations, transformer rail tracks set in concrete and coal handling hopper, ash sluice, and condenser pits.
- The complete site works, including flexible road pavements and stormwater drainage. <sup>1</sup>
- Penetration drawings for all the concrete structures.

The Collinsville Power Station<sup>9</sup> is 170 miles southwest of Townsville and the same size and capacity as Calcap Stage I, and it represented \$1,700,000 worth of civil and building works.

Another major project in the office was the Victorian Arts Centre from 1962 to 1968. Work included both structural and civil engineering.

#### Structural:

The work performed by MJA in connection with the construction of the Victorian Arts Centre Gallery Project fell into three phases, viz.

1. 1962 to 1963. Design and supervision of foundations involving 12 miles of 105T, 18" octagonal pretensioned piling (90 ft. max. length); 4,000 cu. yd. of reinforced concrete in pile caps and footings and 1,500 cu. yd. of reinforced concrete in deep basements.
2. 1963 to 1965. Supervision of construction of the two storey car park below St. Kilda Road level, which occupies 4 acres per floor. This structure consists of 29,400 cu. Yd. of reinforced concrete in floor slabs, service core and podium level pools and garden slabs, with 2,170 Tons of structural steelwork in the gallery floor grillage and flat slab columns.
3. 1966 to 1968. Supervision of construction of the structural skeleton of the gallery building. This extensive 5 storey building included 9,100 cu. yd. of reinforced concrete in load-bearing walls and floors and 630 tons of structural steelwork.

MJA also was commissioned to design and supervise the cooling tower concrete structure and garden area walls and roads.

#### Civil Engineering

The office designed and supervised the installation of hydraulic services ranging from stormwater drainage and ornamental pool water supply, waterproofing and water filtration to special hydraulic effects such as the foyer water curtain and courtyard jets and dolphins.

#### *Stormwater Drainage:*

The drainage of the Centre's 7 acres including the design of drainage reticulation to large garden areas, courtyards and planting pockets, pool overflows and vertical downpipes linking surface levels and an underground drainage system of 3,800 ft. of concrete pipes laid beneath the lower car park floor. As these pipes are below the level of the Sturt Street stormwater outfall, a silt pit and pump well equipped with 2 No. 7 cusec pumps was incorporated for their discharge.

#### *Ornamental Pools:*

The 1 million gallons of water contained in the 43 ft. wide by 3 ft. deep pools surrounding the Gallery Building posed many interesting hydraulic problems; namely, the provision of pool

---

<sup>9</sup> The coal for Collinsville came from local open-cut mines. Collinsville was commissioned in 1968 with four 30 MW steam turbines. A 60 MW machine was later commissioned in 1976. These were refurbished in 1999 and upgraded to 66 MW and 31 MW respectively. They were decommissioned by 2018.

overflows capable of storing water lost through evaporation, wave action and cleaning operations and the continuous filtration of all pool water. The solution has involved the design and installation of stainless steel overflow launders, reinforced concrete balance tanks of 350,000 gallons capacity, a filtration plant of 1,000 gal/min capacity and a complex system of pipework and controls.

*Jets and Dolphins:*

This effect situated in the Bamboo Courtyard comprises 3 No. parabolic jets of coherent water emerging from the pavement, rising to 25 ft., and disappearing into catch boxes flush with the pavement 6 ft. away. Two Dolphin Jets were also provided, similar to the above but fitted with a cut-off device that created slugs of water following a parabolic path. Whilst the basic jet nozzle for this effect was developed in the Robin Laboratory, the University of Adelaide, MJA designed all automatic valves, pipework, control devices, splash boxes, and filtered water supply tank for the installed effect.

*Foyer Water Curtain:*

The foyer water curtain effect consists of a plate glass wall 70 ft x 24 ft. with a thin continuous stream of water running down the face of the glass at velocities producing an interesting set of changing flow patterns. The office has developed the effect beyond the original concept and designed and supervised the installation of all jets, orifices, pipework, troughs, and glazing supports.

*Waterproofing:*

The waterproof membranes required for this project included linings for pools, courtyard pavements, and soil and concrete interfaces to gardens, lawns, and planting pockets, involving a total of 4 acres of membrane and 4,000 ft. of jointing.

Many alternative waterproofing materials were considered and compared and selected in conjunction with CSIRO. Finally, tenders were called, and all phases of construction were supervised by the office.

*Site Investigation - Victorian Arts Centre Art Gallery and car parks*

The aim of the investigation was to:

- To ascertain the soil conditions at the site to enable an examination to be made of alternative foundation systems for the Victorian Arts Centre, to select the most economical and satisfactory of these.
- To provide information for the detailed design of the selected foundation system, retaining walls, and drainage system and for slope stability analysis.
- To provide information and anticipate any construction problems.

Scope:

The investigations were initiated in 1962. A total of 39 No. boreholes to depths up to 120 ft. were drilled over the site between this date and 1964, each of the holes being drilled through the soft organic clay sediments into the base Silurian rock. Investigations included the performance of a wide variety of soil tests in the laboratory. These investigations covered all the aspects referred to above.

Results:

The investigations revealed that the surface of the Silurian base rock sloped steeply across the site and the thickness of the organic clay sediments varied from nothing at the northeast corner to 80 ft. thick along the Sturt Street frontage. In addition, up to 40 ft of filling was present overlying the organic clay. Studies showed that neither spread foundations nor piles supported by the filling or organic clay would be suitable, owing to the very large settlements which would result. On the

other hand, the Silurian rock provided an excellent supporting medium, and precast concrete piles were found to be the most suitable means of transmitting the loads to this stratum. Stability analyses enabled a stable slope to be selected on the St. Kilda Road frontage, dispensing with a costly retaining wall.

#### Northern End Development

In 1966, investigations were completed for the development of the northern end, which is to include the construction of the 415 ft. high tower and Underground Auditoria. Feasibility studies have shown that it is possible to excavate to the Silurian rock at a depth of 115 ft. over this part of the site and to provide the necessary support for lateral earth pressures up to 2½ tons/ft<sup>2</sup>,

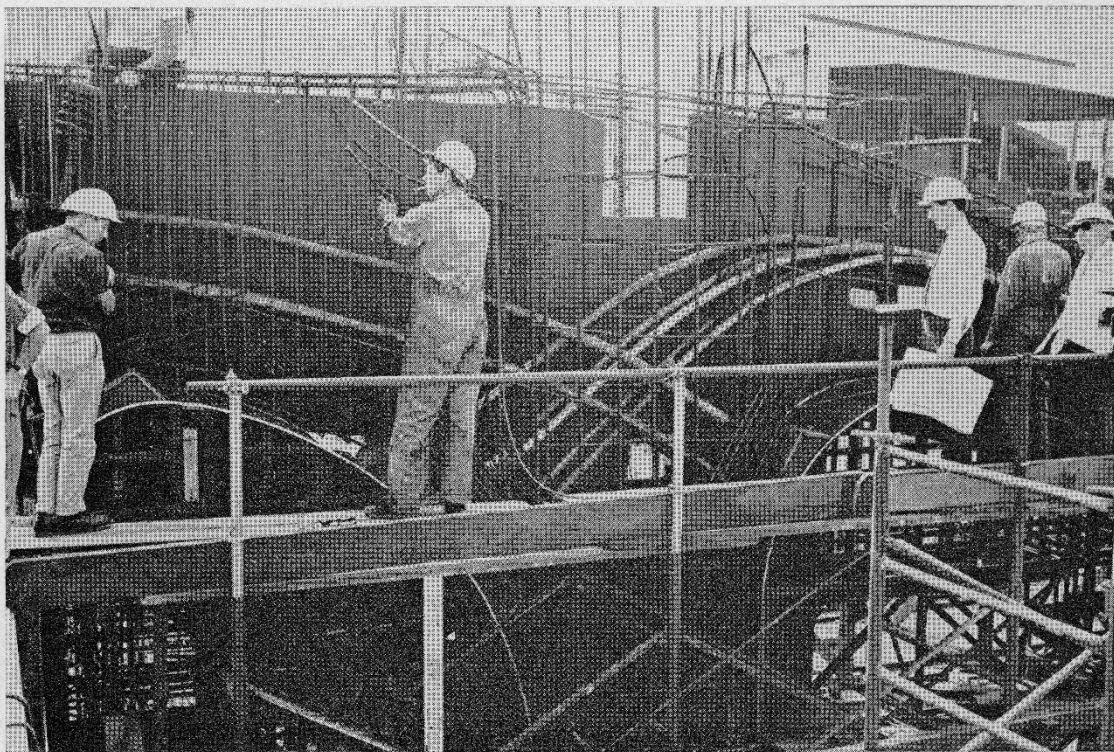
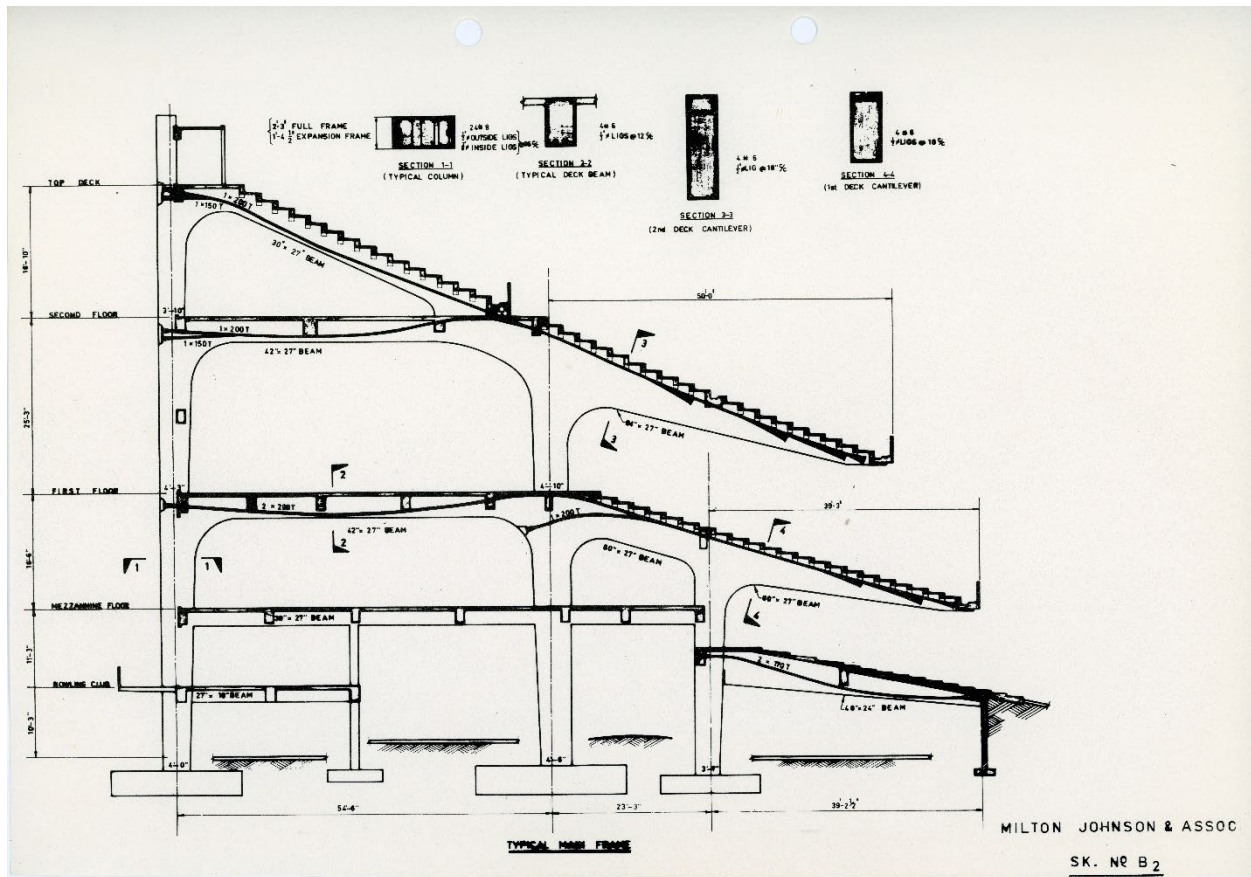
Another project the office was involved in was the new Western Grandstand at the Melbourne Cricket Ground (MCG), designed about 1965 by the architects Tompkins, Shaw and Evans. The new grandstand replaced the Grey Smith Stand of 1906. The builder was AV Jennings, and the foundation stone was laid by the Duke of Edinburgh on March 3, 1968. The stand was opened by Lieutenant Governor Sir Edmund Herring on August 9, 1968, and it cost \$2.315 million and had a capacity of 31,000 people.

The structure was approximately 500 ft. long and had three-tiered levels. A special feature of the design was the absence of any columns which would obstruct the spectators' view. This has been achieved using cantilevers (as shown on the cross-sections), which provide free projections of 40 ft. and 50 ft. at the first and second decks, respectively. Construction was entirely in concrete, with the main frames prestressed by post tensioning with BBR cables and precast pretensioned deck units.

Quantities.

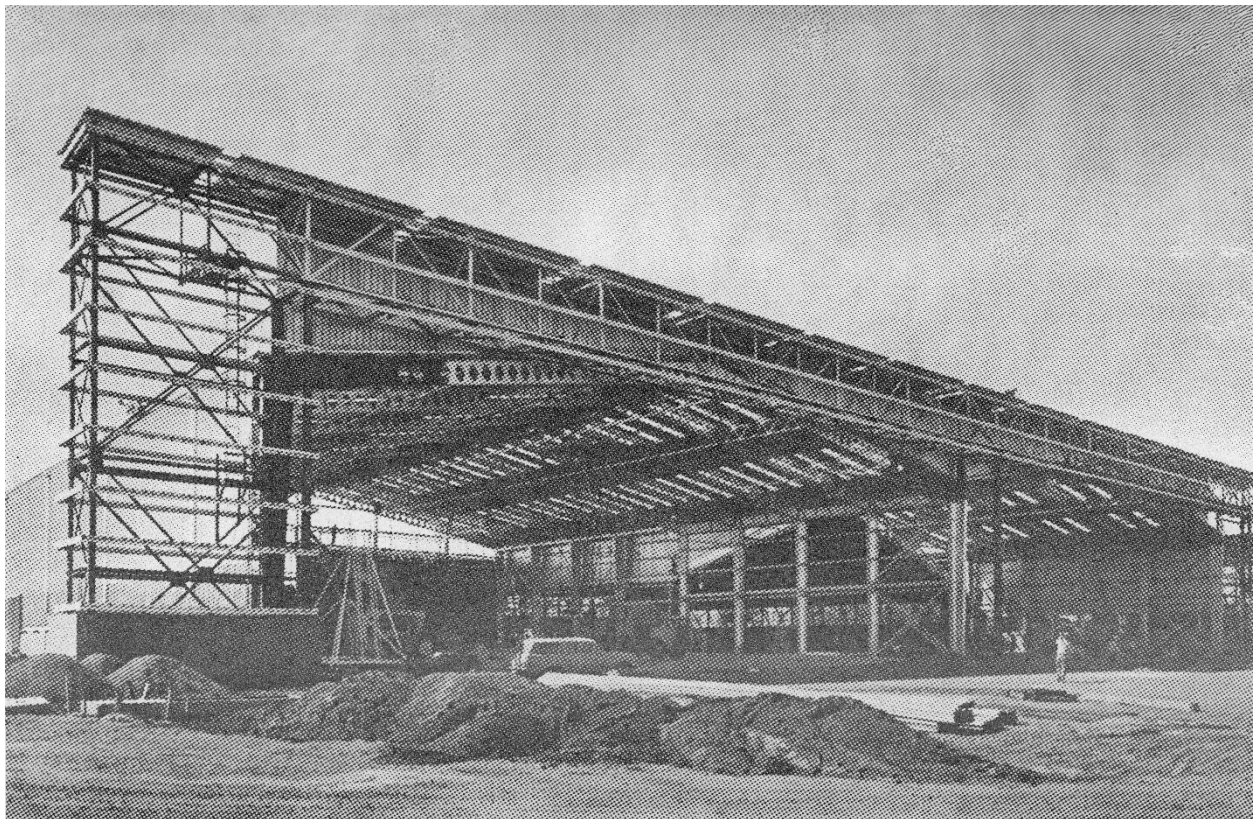
- Concrete 12,500 cubic yards.
- Reinforcing steel 800 tons.
- Prestressing wire 200 miles.

The work commenced in November 1966 and was completed in July 1968. It was subsequently renamed WH Ponsford Stand on December 6, 1986, in honour of former test and MC cricketer Bill Ponsford. The stadium was subsequently demolished to make way for a larger grandstand between 2003 to 2005. I remember attending a match at the MCG, and we measured the period of vibration when the crowds stood up and cheered.



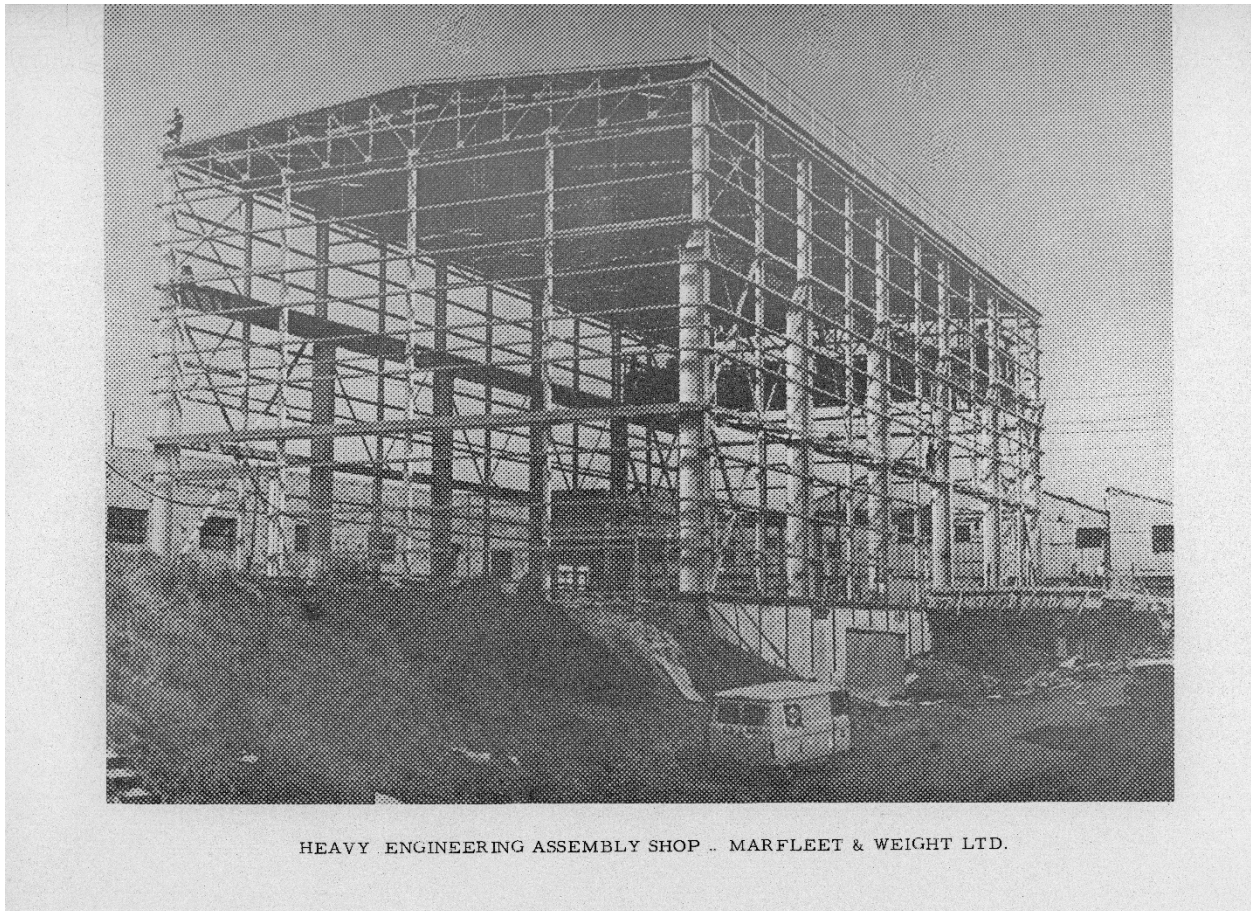
Intersection of tendons at C line column in typical truncated frame at first deck level.

Another project in 1964 was the Boeing Line Maintenance Hangar for Ansett-A.N.A. The introduction of the Boeing 727 aircraft in 1964 necessitated hangar modifications in Sydney and Melbourne. Whereas in Melbourne, the objective was achieved by raising the existing door openings, in Sydney, a completely new hangar was required. An existing prefabricated steel Butler type hangar was added to and duplicated in steel portal frame construction to give two 135 ft. span hangars high enough to accommodate the Boeing 727 aircraft. The cladding was in tray deck steel sheeting with built-in translucent fibreglass sheeting for daylighting. Electric lighting set new high standards, and the sliding doors, 38ft 6in high, were motorised. The hangar is fire protected by a deluge system, while a supply store and workshop at the rear were fire separated and sprinklered. This steel portal frame design was subsequently repeated at Melbourne in single bay width, with an annexe, to give additional hangar space.



AL6 BOEING LINE MAINTENANCE HANGAR, ANSETT ANA,  
SYDNEY AIRPORT  
TWO CLEAR SPANS EACH 135 FT.

In this era, another project was the design of a heavy engineering assembly shop for Marfleet & Weight Ltd. The plant extension at Abbotsford consists of a steel clad structural steel framed heavy workshop 151 ft by 77 ft, overall, with a clear height of 51 ft. The building housed an overhead travelling crane of 50 tons capacity, and the whole structure was supported upon 61 No. piles of an average depth of 40 ft. the project included a two storey reinforced concrete office block of 3,920 sq ft, floor area above car parking facilities was also designed it was constructed alongside the heavy workshop. The whole project was completed in 1965.



The firm also did work for the cement company Australian Portland Cement Ltd <sup>10</sup>(APCL) at Fyansford near Geelong. One project was a limestone plough bunker<sup>11</sup>, as the quarry limestone was brought by a private railway to the factory, where it was crushed and handled. The railway line was replaced by a 2 ½ mile overland belt conveyor from a travelling stacker and bunker.

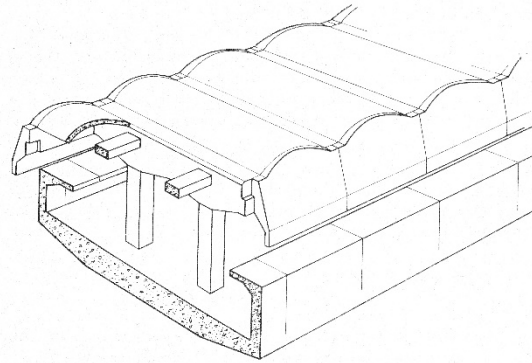
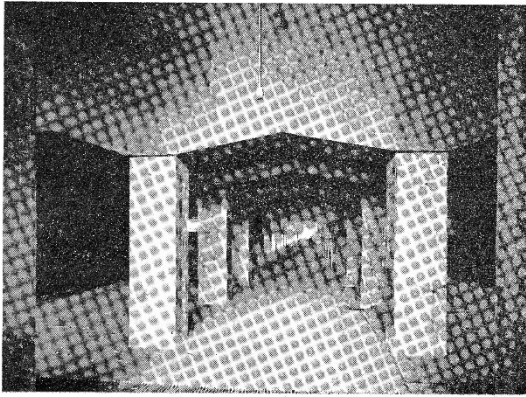
In March 1965, MJA was asked to examine possible alternative designs to reduce the cost of the bunker. The limestone provided a maximum pressure on the roof of the bunker of 3,850 lbs per square foot or about 180KPa (18,800 kg/m<sup>2</sup>). Several schemes were considered, and finally, an arch roof was adopted. Tenders were called in February 1966; construction started in April 1966 and was completed on schedule in October 1966.

---

<sup>10</sup> Operated by the Australian Portland Cement Company under the brand name of Geelong Cement, the Fyansford cement works was a major industry for the Geelong Region and was in operation across the 20th Century. Opening in 1890, the cement works took advantage of several limestone deposits that could be quarried at nearby Batesford. Despite some early financial setbacks, the cement works embarked on the first of many expansions in 1912 when an aerial ropeway opened to transfer the stone in large buckets from the quarry to the original works in Fyansford. Cement at the time in Australia was in great demand, so expanding the plant allowed the company to keep up with demand and lower our reliance on imports.

The original facility was on the corner of Hyland Street and Deviation Rd, slowly over the years the facility expanded across Hyland Street to a new plant that eventually became the main plant. Today this area is now a housing estate with the last remnants of a plant disappearing in 2004 when the tall kiln chimneys originally built between 1958 and 1968 were knocked down with explosives. The original plant was mostly gone by the 1980s with the exception of the concrete base of no 3 chimney that can still be seen on Hyland Street with the inscription of "A.P.C. Established 1890" in large lettering. In 1918 a branch extension of the Geelong railway line extended from North Geelong to the top of the Fyansford hill was completed, allowing for easier transport of cement products. Later in 1926, a private narrow gauge railway replaced the ropeway transporting limestone from the quarry to the plant. The railway was noted for incorporating a 1.3km tunnel which was the longest in Victoria prior to the Melbourne loop opening. This narrow gauge railway itself was replaced by a conveyor system in 1966, part of which still stands and can be seen from the Geelong Ring Road. Today some of the locomotives of the private railway are in the hands of the Bellarine Railway. The Geelong Cement plant closed in 2001.

<sup>11</sup> *Constructional Review* Vol 40, No 5, Page 17, May 1967



*Figure 2. Final scheme adopted.*

**Plough bunker for limestone at APCL**



**A general view of the plant and the plough bunker can just be seen in the bottom right-hand corner.**

At this time, another project was slurry silos and basins for Australian Portland Cement Ltd (APCL) at Fyansford near Geelong. This project consists of eight 100,000 gallon slurry silos and one 670,000 gallon slurry basin. The silos are of reinforced concrete, 20 ft. in diameter and 50 ft. high, and are supported on a reinforced concrete slab 12 ft. above ground level. The silos were constructed using continuously sliding forms. Beneath the slab is the laboratory, switch room, compressor room, an amenities section, and below ground a 20 ft. deep pump basement. The slurry basin is 82 ft. in diameter, 20 ft. deep, and of reinforced concrete. The slurry in the basin is stirred by a single arm stirrer supported on a central column and riding on rubber wheels on the top of the wall. Responsibilities in this \$360,000 project included preliminary investigations and feasibility studies, detailed design, calling tenders, and supervising construction.

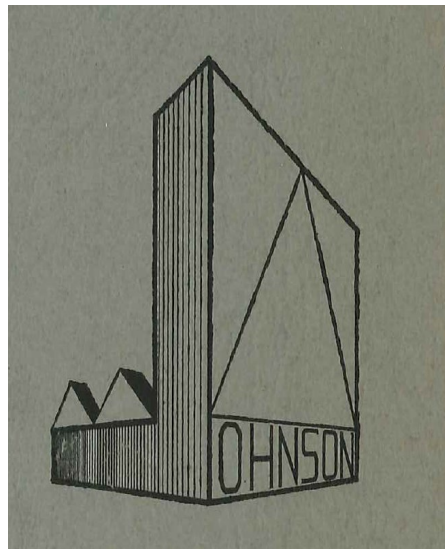
## 1967-1971

### 1967

In July of 1967, the writer John Woodside completed his Master of Engineering Science at Melbourne University. He commenced work on 3 July 1967 with the Consulting Engineers, Milton Johnson and Associates (MJA) in Melbourne as an assistant engineer on a salary of \$3,600 per year. Their offices were at 317 Collins Street, Melbourne, their phone number was 62 3173, and their telegram was MILTJON. This was his first job in structural and civil engineering, and this was to be his career for the next 55 years or so.

I remember Milton Johnson had a number of companies, and I was paid by a company called Stress Calculators, which I think was also Milton's development company for building flats and similar personal projects.

This was an era when there were plentiful engineering jobs, and most state and federal governments also recruited engineers, and often, they were indentured for several years after graduation as their fees were paid by the government as part of a cadetship. I am not quite sure how I chose Milton Johnson and Associates, but they were recruiting strongly at the University of Melbourne.



The firm had its headquarters in Melbourne with Milton Johnson<sup>12</sup> as the Principal and five Associates with Tim Langley (Chief engineer), Don Bentley (Executive engineer), John Gellie, Brian Whitehead, and John Hayes as Associates. I mainly worked for John Hayes. Milton Johnson lived at 8 Ledbury Court, Toorak Vic 3142. I think he had a hearing problem, as he spoke with a loud booming voice, or maybe that was just Milton.

The work Milton Johnson and Associates carried out was varied, and they did not seem to work for many architects but mainly worked for industrial clients. Often, they did the complete package, including civil, structural and architectural, if required. They did a lot of industrial buildings, including steel framed buildings and the like and were not involved in any significant commercial buildings. They

---

<sup>12</sup> Raymond Milton Johnson 7.6.1925 - 13.5.2014. Following his graduation at the University of Melbourne, he went to the USA where he was a Teaching Fellow at Harvard University. He graduated there as a Master of Science in Civil Engineering, after a Postgraduate Course in Soil Mechanics and Foundation Engineering. Gaining further experience in this field in the United Kingdom, He lectured at the University of Melbourne for 12 Months and was responsible for the initial development of their source laboratory. After further experience with a firm of consulting engineers Mussen and Mackay, he established his own firm in 1952. In 1979 Milton retired from active practice, aged only 54. Ten years later he sold his company Soilmech.

often carried out contract administration and supervised contracts.

Opening the windows operated our air-conditioning at 317 Collins Street. MJA had just documented the \$2.5m New Western Stand at the MCG, which was being constructed when I joined them. It replaced the Grey Smith Stand and the open concrete stand next to it, and the Duke of Edinburgh laid a foundation stone for the Western Stand on 3 March 1967, and it was completed in 1968; in 1986, it was renamed the Ponsford Stand in honour of Victorian batsman Bill Ponsford. This stand was demolished in late 2002.

One of the features of construction in Melbourne in this era was the construction work by EA Watts and the demolition by Whelan the Wrecker. EA Watts started before the First World War in Melbourne, and by the time I started my career, they were one of the most prominent builders in Australia, but they faded away in the 1990s because there was no one to continue the business into the future.

As a graduate engineer, the author got a good grounding in civil and structural engineering and learnt about being involved in consulting engineering practice with things such as timesheets, job numbers, productive jobs and unproductive jobs, design and documentation of projects, contract administration et cetera.

Junior engineers and drafting staff wore smocks because of the use of ink, and engineers drew their details at scale, and they were handed to another staff member known as the tracer, who traced it onto a drawing correct in scale and correct in position.

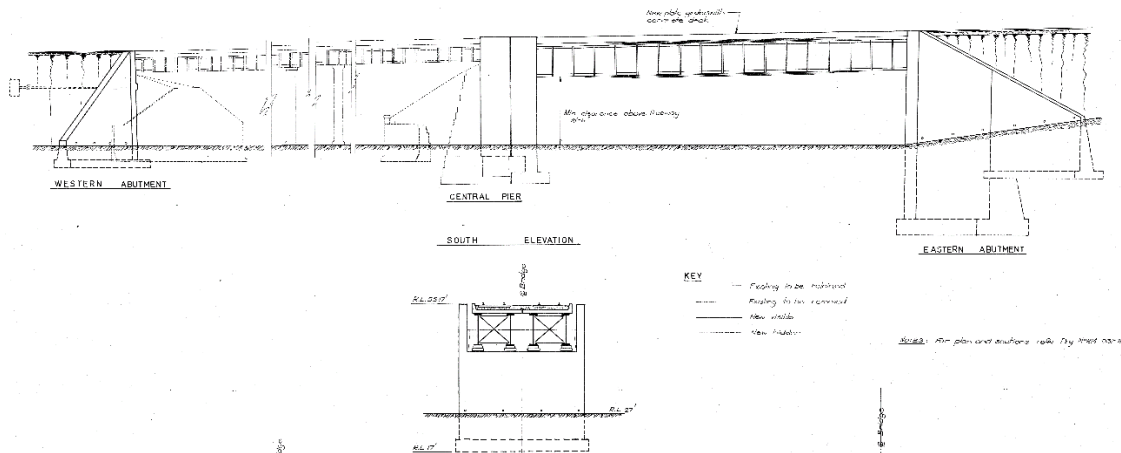
In those days, engineers used slide rules for calculations as calculators were unknown except for adding machines, which were rare. All drawings were in Imperial dimensions in feet and inches, and all calculations were in units such as kips and psf. We had no photocopier. All computations were made on foolscap transparent drawing sheet material in ink or HB pencil and then run through the ammonia print machine using sensitised paper. Engineers drew sketches and details to scale, and we had tracers draw them as neat drawings using ink or pencil. I worked at MJA under John Hayes and the Chief Engineer Tim Langley, and Tim later worked for Connell Wagner (CW) in Melbourne and Darwin before retiring to Brisbane in 1996.

Owing to a tight program, the MMBW enlisted the aid of several prominent Melbourne consulting firms to assist them in completing the design for the new Tullamarine freeway and a number of the freeway bridges. It appeared that John Connell and Associates (JCA) and Milton Johnson and Associates (MJA) formed a partnership for this project.

The author initially worked a 70 ft. prestressed freeway bridge, three elevated prestressed pedestrian bridges up to 400 ft. in total, and a 100ft span riveted steel plate railway bridge at the start of the freeway near Flemington Road. All these bridges are still standing today as you drive from the Melbourne Airport to the city. The 3 footbridges had to suit not only the initial stage of the freeway but the ultimate widening of the freeway, which involved 2 additional spans on 2 of the bridges and the relocation of one support. There were bridges at Brentwood Avenue, Evans Street and Wheelers St at Pascoe Vale. I was involved in the design of the steel bridge at Flemington Road and the Evans Street footbridge as well as the freeway bridge near Evans Street.

The railway bridge was interesting as the Victorian Railways required the bridge to be fully riveted, and by then, rivets had largely gone out of use in Australia. It was fabricated by A Challingsworth in Swan Street in East Richmond. The firm made permanent way infrastructure such as steel beams and rolling stock for the Victorian Railways. It was an interesting erection procedure as the abutments and wing walls were constructed in the embankment, and then the steel trusses were erected beside the existing railway with the concrete slab, ballast and new rails. The railway line was then closed for a weekend,

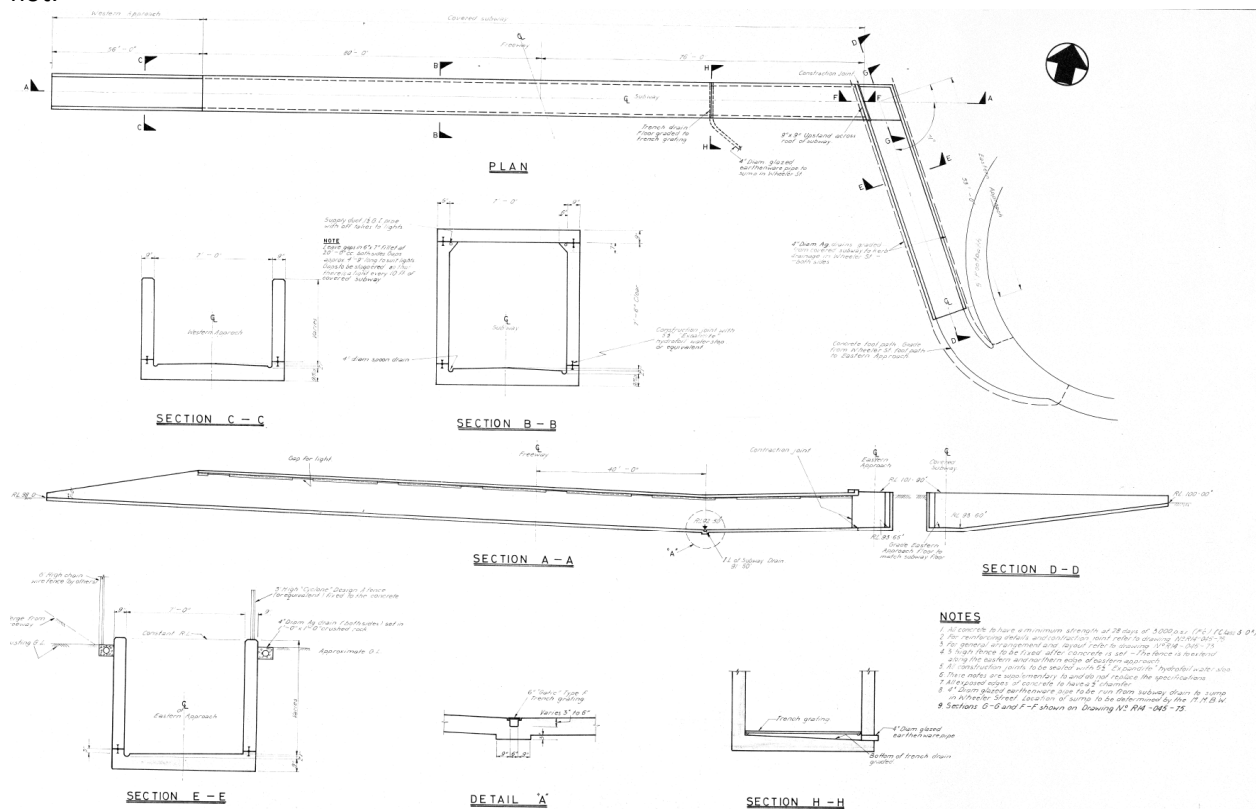
and the old railway line was removed; the two new trusses were pushed into position and erected, and then the ground underneath was removed. I think MJA was only responsible for the design.

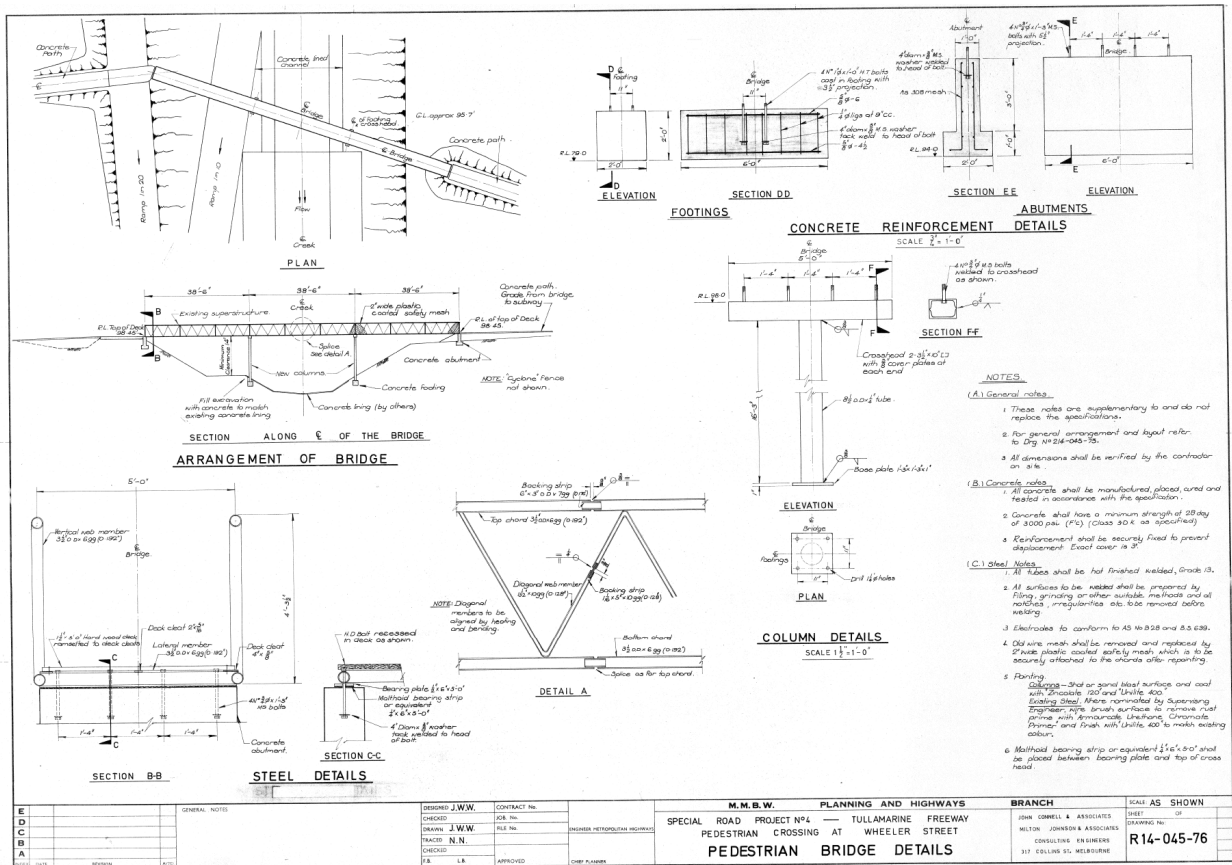
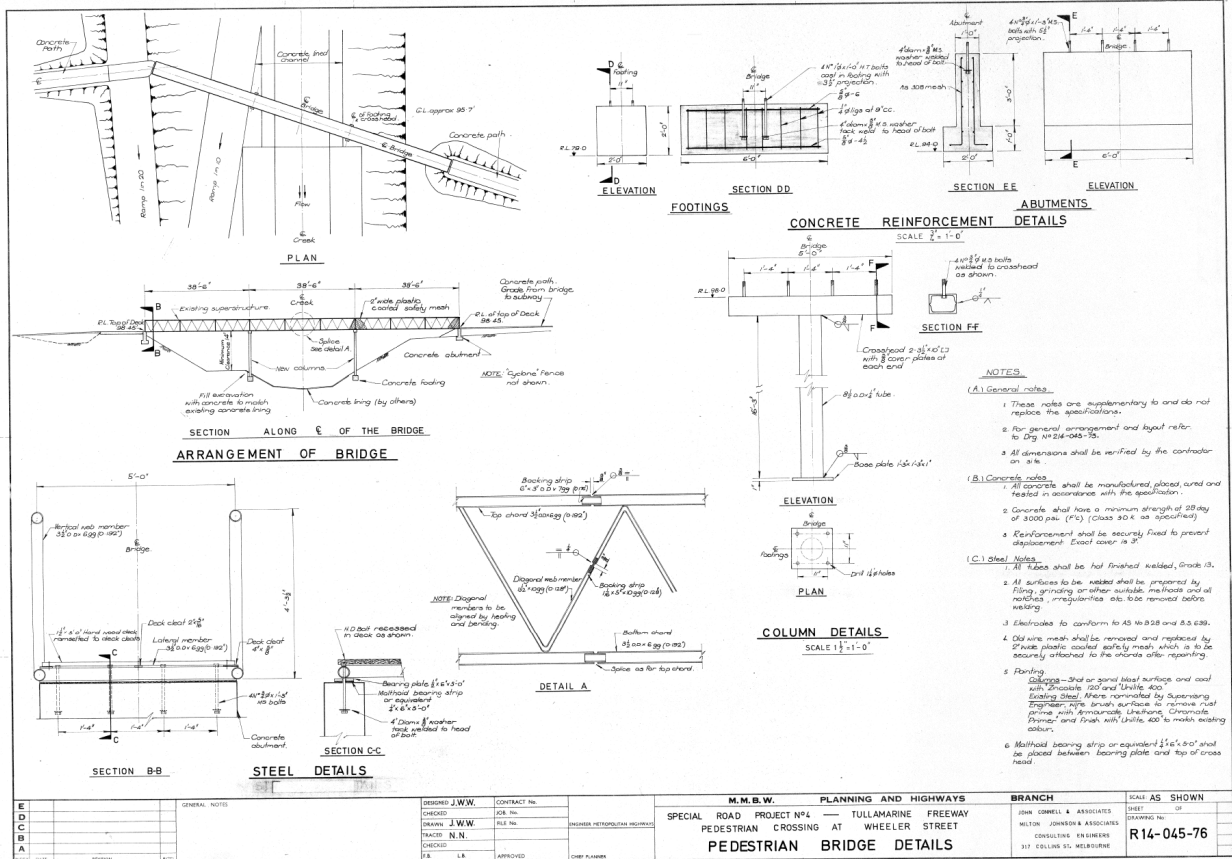


**South elevation of the railway bridge at Flemington Road**

The two concrete footbridges at Brentwood Avenue and Evans Street were cast in situ with the deck and sidewalks, and horizontal walkways, which were U-shaped, were post-tensioned.

Another project on the Tullamarine freeway was a pedestrian crossing at Willow Street underneath the freeway with a bridge over the Moonee Ponds Creek, but I cannot remember whether this was built or not.





We also documented the reconstruction of a railway bridge near Bell Street in Pascoe Vale, but that did not seem to get constructed.

# Footbridge

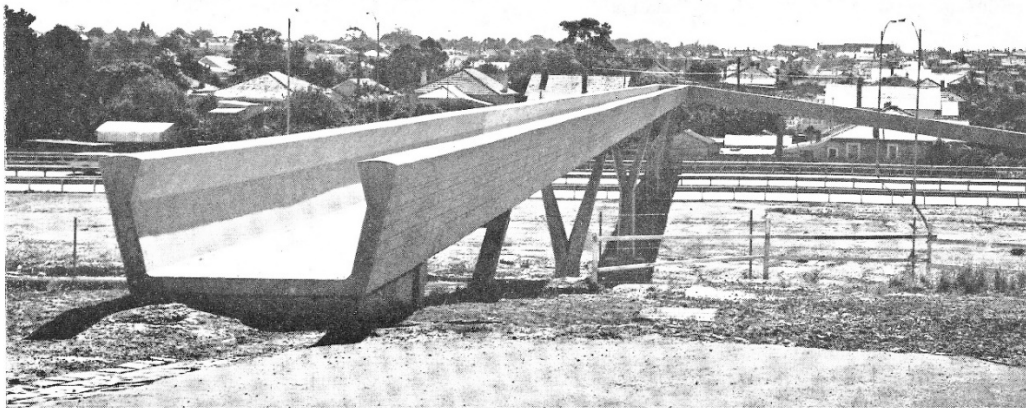
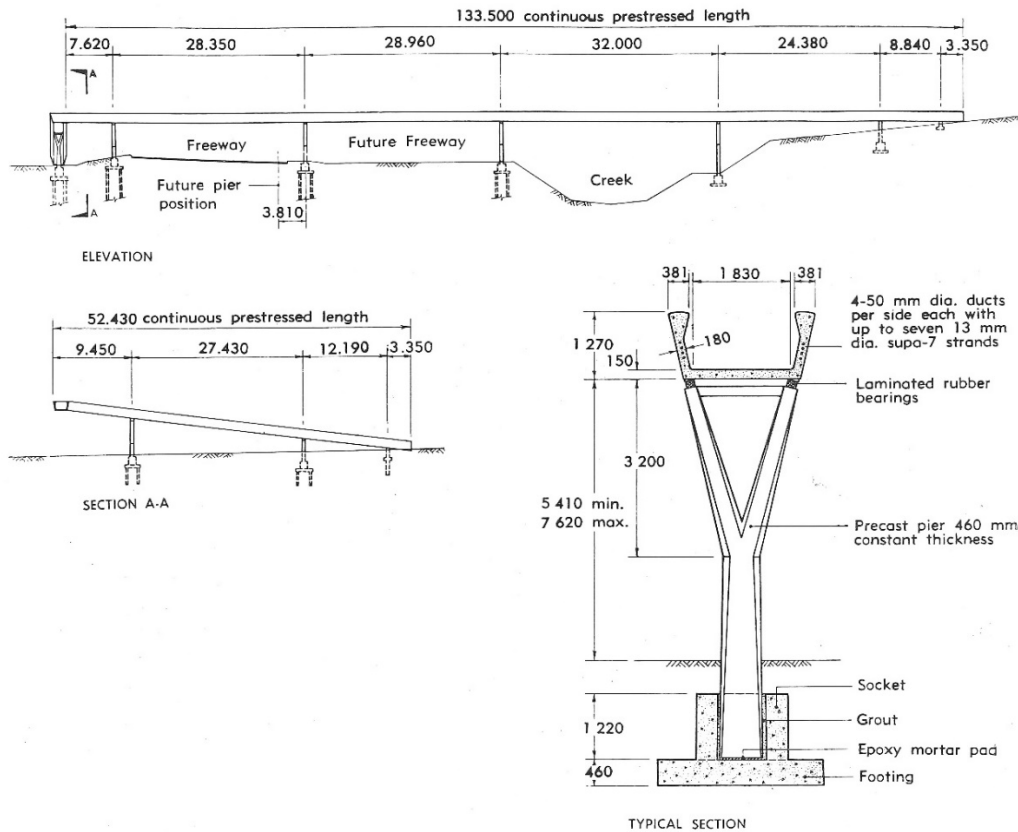
**Location** — Melbourne, Victoria.

**Authority** — Country Roads Board, Victoria.

**Consulting Engineers** — Milton Johnson & Associates.

**Contractor** — Ascom Pty. Limited.

**Cost** — \$(Australian) 55,000.

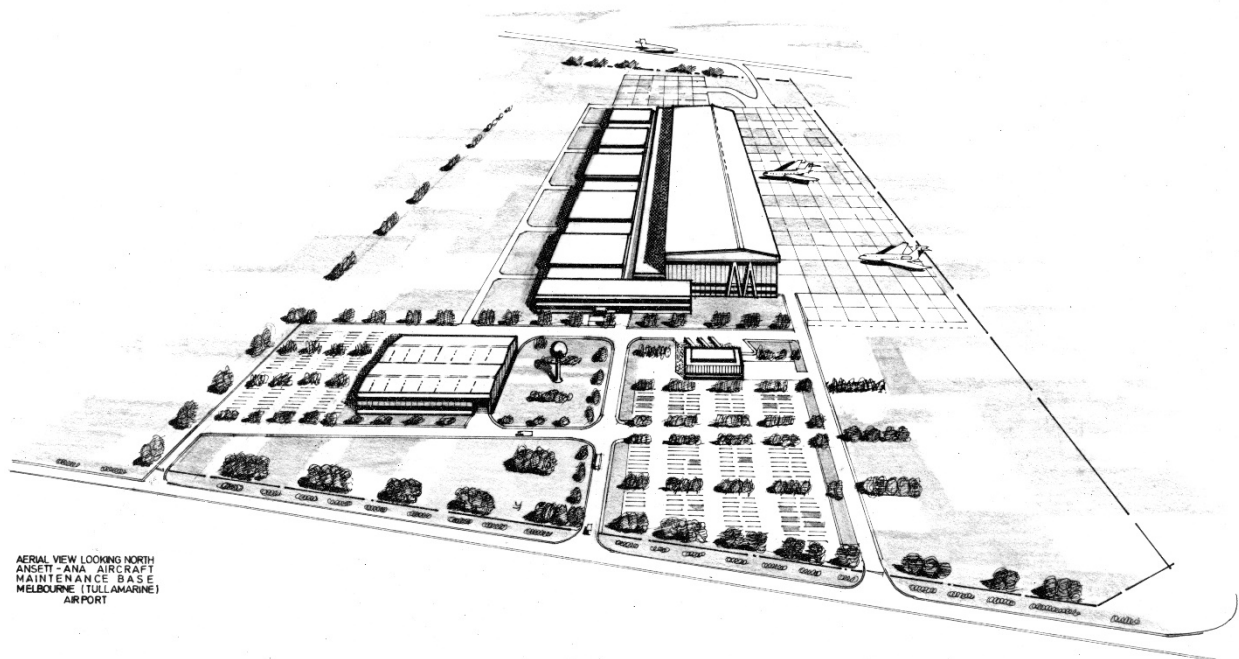


A rather funny incident occurred one lunchtime as the author's identical twin brother was working for Shell Chemical Company in Melbourne. He was in one of Melbourne's book shops looking at a book when Don Bentley sidled up to him and said, "*what are you looking at*" and my brother told him to get lost in less than polite terms. Don was a bit stunned by all this and came back to the office and called me into his office, and asked me whether I had a twin brother, to which I answered, "*yes, and he then said well, you still have a job.*"

I went to a course at the RMIT on designing steelwork using the new steel structures code AS 1250, which replaced Int 351, and Max Lay was the presenter.

MJA provided a general site investigation report for the northern end of the Victorian Arts Centre this year, indicating fill overlying soft organic silty clay and, finally, Silurian mudstone at a depth of 75 to 100 feet.

A very significant project MJA was involved in was the Ansett-ANA aircraft maintenance base at Melbourne airport for 4/727 aircraft, which involved a master plan and construction commenced in 1968 and had to be operational by the end of 1969. The total estimated cost was \$8.28 million.



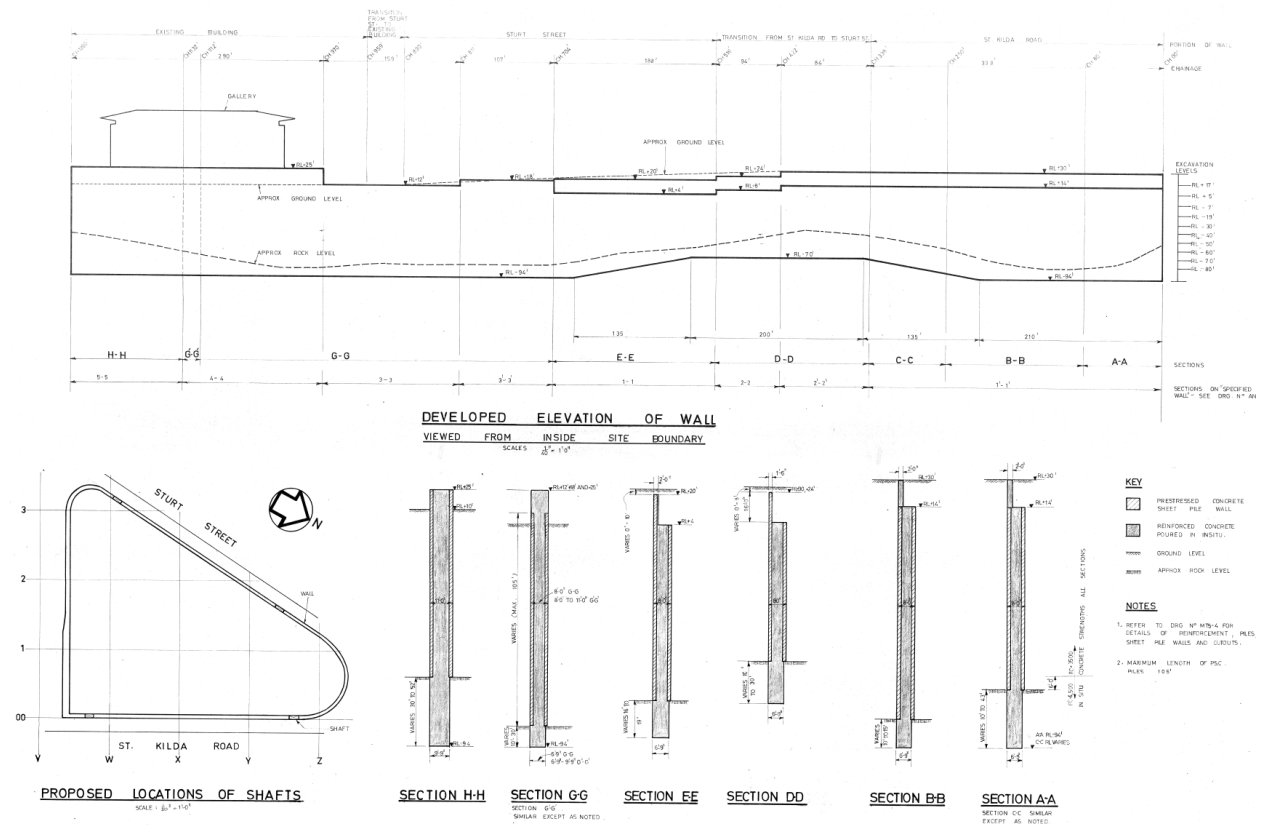
Milton Johnson also did some private development, including a property at Murrumbeena in 1969 and purchased 8 Ledbury Court, Toorak, in February 1968 as his personal residence.

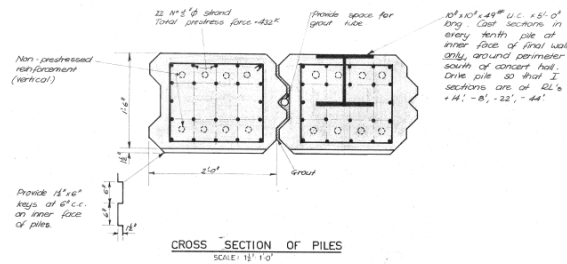
## 1968

I worked for Milton Johnson and Associates for the year. There was a severe recession in 1968 in Australia. Milton Johnson and Associates went from 80 to 10 people in 6 months, as we had no work! However, I was able to survive as I think I was a new graduate and not that expensive, and fortunately, I did not have any dependents. Obviously, the principal and five Associates also survived. There were now only two people in our section, John Hayes and me.

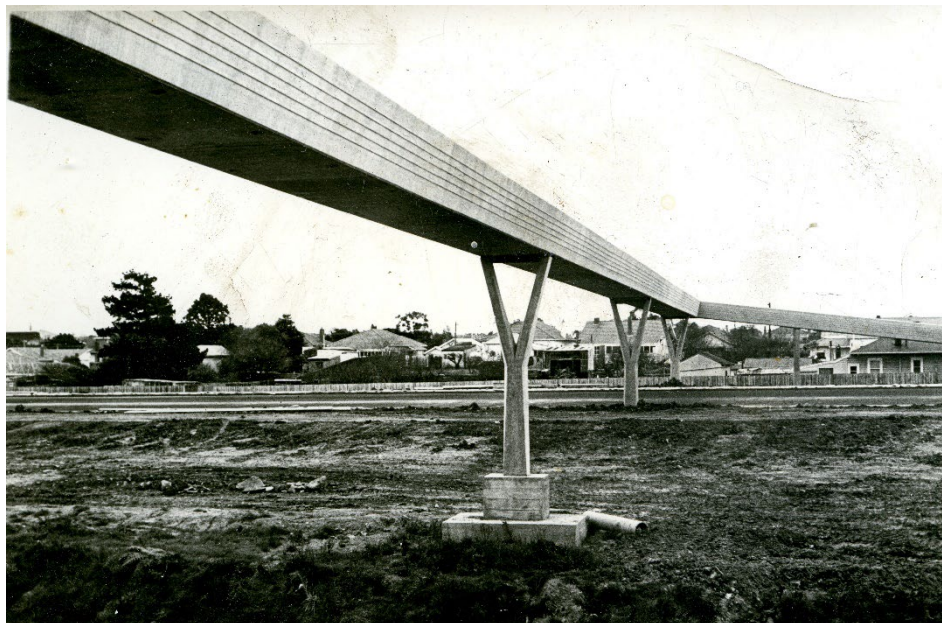
There was extensive office reorganisation, and Brian Whitehead went to Perth to see if he could set up business there. A number of the engineers, including Colin Knowles, Dick Trembath, Kevin Scully, and Mike Corbett, were all seeking interviews with other organisations, and it appeared that Milton Johnson was trying to make sure everybody had a job by giving staff time off to seek interviews and I think by and large most staff found a new position. As a new graduate, I was not all that worried as I was unfamiliar with the effects recession. However, having been through a number of these recessions over the last 55 years or so, they are tough on staff as well as directors, as the main costs were staff salaries, and if you have no income coming in, a consulting practice cannot afford to pay staff.

One of my first jobs was the modification of some heavy machinery foundations at the cement plant at Geelong, and in February, I was involved in the tender design for the contractor McDougall Ireland for a wall 1200 feet long by 100 feet deep and 15 feet wide to enclose a  $1\frac{3}{4}$  acre site at the northern end of the Victorian Arts Centre using sheet pile walls of prestressed concrete piles at an estimated cost was \$4.5 million. It was a significant project, and I helped one of the directors John Hayes who did most of the design.





In February, construction of the Evans Street Footbridge Bridge over the Tullamarine Freeway commenced. I also visited the site on Friday, 19 April, and two columns on either side of the creek had been erected. I revisited the site on 23 May to inspect the works. I have to say my site experience was minimal, but I managed to get through it.



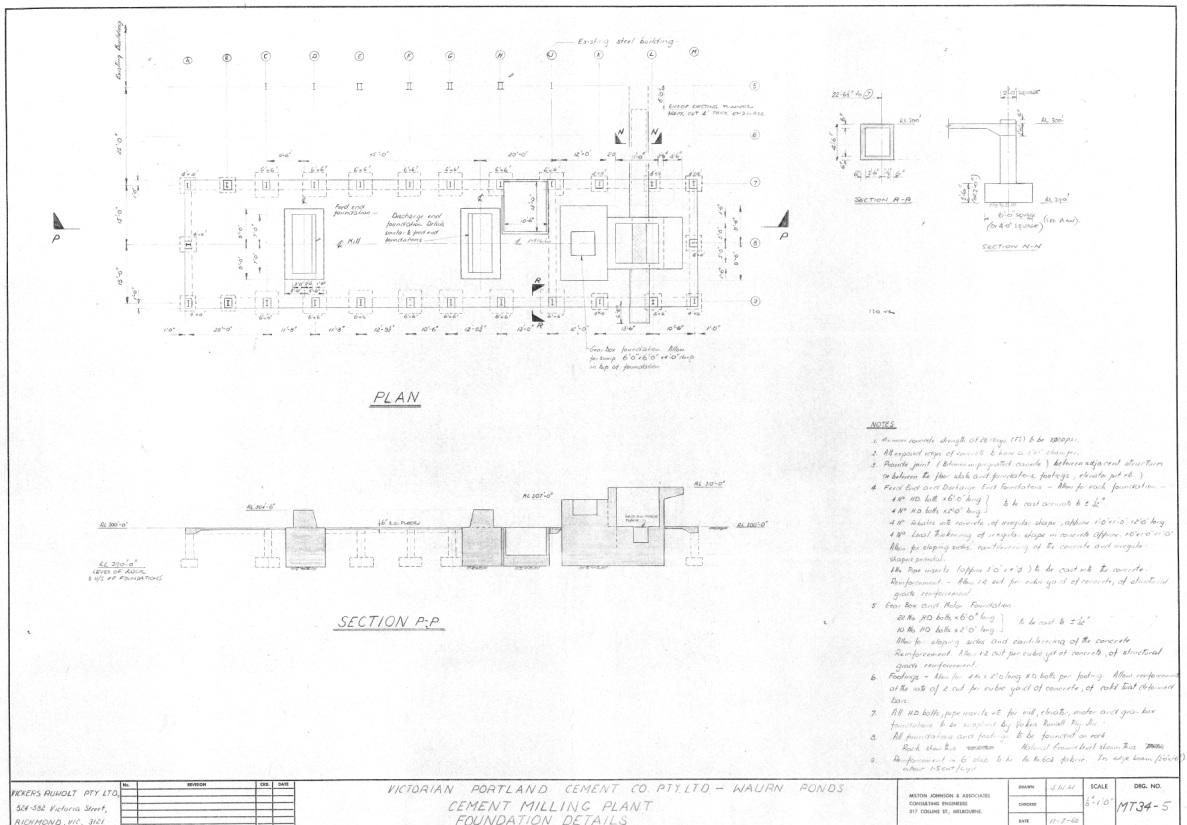
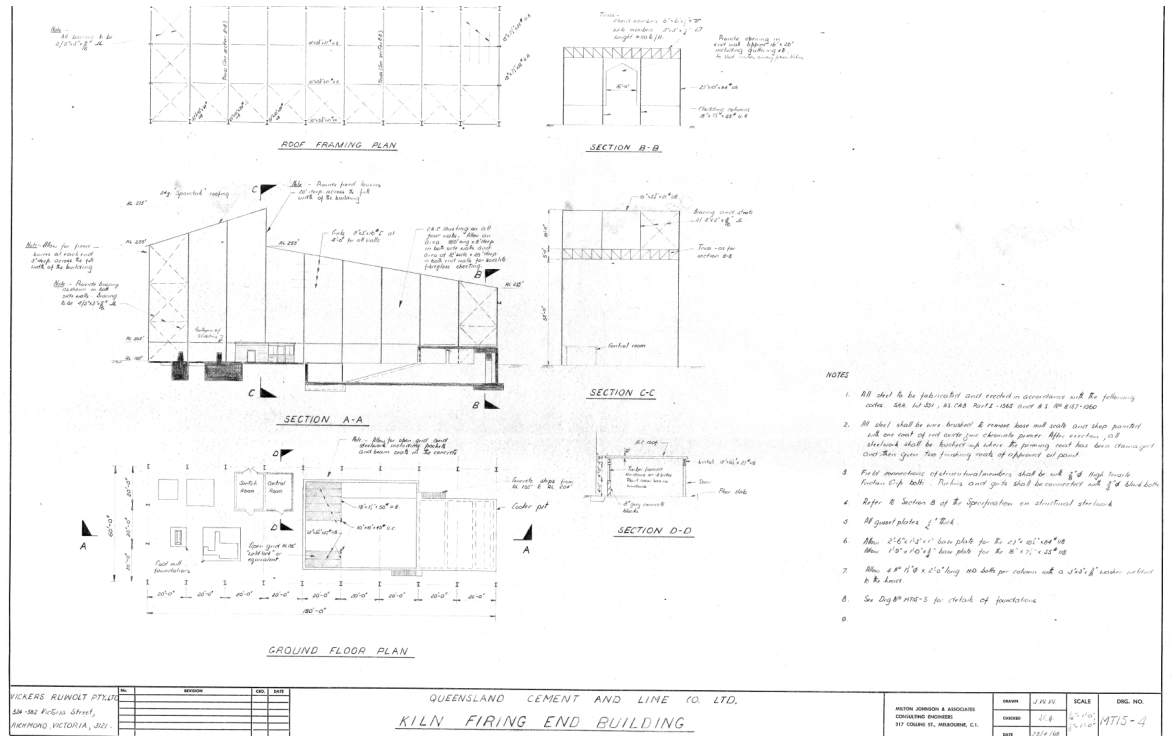
**Evans Street footbridge before the freeway was constructed**

In April and May, I was involved in the tender design for a cement plant at Darra in Queensland, including a steel framed building, heavy plant foundations and a kiln for a cement plant in Townsville for Queensland Cement and Lime Co.

In June, I was involved in the design of a cement mill at Waurin Ponds near Geelong in Victoria for the Victoria Portland Cement Company.

From July to November, I was involved in the design of a structural steel building and plant foundations for The Northern Australian Cement Ltd, including a kiln feed in building which was 35 feet by about 24 feet in plan and about 70 feet in height with two floors, kiln and cool pit foundation, and a kiln discharge in building at Stuart, Townsville in Queensland. These jobs were for Vickers Ruwolt in Victoria Street Richmond, who seem to give us a steady flow of work in the cement industry. After that initial experience, I never was involved in any further work in the cement industry in Australia for the rest of my career.

A brief history of R Milton Johnson (RMJ), Milton Johnson and Associates (MJA)  
Milton Johnson and Partners (MJP) and MJ Consultants 1952-1985  
Consulting Engineers



The office started documenting the Ansett-ANA Aircraft Maintenance Base at Tullamarine airport.

My gross salary for 1967/68 was £4,172, and a bonus of £170 which was about 4% which wasn't a lot.

## **1969**

I worked at Milton Johnson and Associates on a variety of projects for the year.

Sometime this year, in about May, the office moved to "*Total House*"<sup>13</sup> at 180 Russell Street, Melbourne, Ph 663 2233, cable "MILTJON". The office block was on top of a multistorey car park. MJA was a smaller firm now but had rebuilt to about 30 staff.

My work for the year MJA consisted of supervising a cement plant in Townsville, including checking shop drawings and modifications of the design, but I did not go to the site.

I was off work for a couple of weeks because of my father's death. He was overseas in Japan marketing rice for the Rice Growers Cooperative Mills, of which he was chairman. On 20th March 1969, my father died in Okinawa, Japan, aged 64 years. It was a great shock to all of us, and I believe my mother never got over his death. Mother was on her way by plane to him in Okinawa, and when she arrived, she was advised that he had died, so she returned immediately to Sydney on a return flight. By this time, all the sons were in Sydney to meet Mother after 20 hours of travel, and it was a very traumatic time. We stayed with a family friend Grace Kevan at 13 Jersey Road in Paddington in Sydney. The funeral was held in Griffith about a week later.

On the weekend of 3-4 May, I drove to Griffith, and on Sunday, 4 May, I, unfortunately, had my left hand caught in the chain drive of a header and lost the top of two fingers of my left hand, which resulted in me staying home on the farm for 2 weeks while I recovered. I had to go to the outpatient department at Griffith Hospital every couple of days to have my hand dressed. Fortunately, it has never really hampered me, although a bit of a nuisance, and I have been able to do most things. I returned to work in Melbourne on 18 May.

In April, Milton Johnson went on a tour to Japan, and he brought back a calculator, which cost a lot of money (several thousand pounds and now you can buy similar one for about \$30, so how technology has changed), and engineers keenly fought over it to use rather than a slide rule. It costs about \$5,000 in today's value, and you can buy one at Kmart for about \$29.99, incl GST, so how the technology has changed.

From March to November, I was involved in the design and drawing of a 3,300 hp cement mill at Goliath Portland Cement at Railton in northern Tasmania, which included site works, a steel gypsum bin, including supporting steelwork and footings, a control room and switch room, a transfer building, a structural steel building 300 feet length of concrete reclaim tunnel, heavy plant foundations and elevated concrete floors again for Vickers Ruwolt, and Dillham was the contractor.

On one occasion, I flew over to Launceston with John Hayes to meet the steel fabricator, and on the day of our visit, there was an explosion of a large gas cylinder at the fabricator's factory and two men, unfortunately, were badly burnt and subsequently died which was rather sobering for a young graduate.

---

<sup>13</sup> *Total House was one of a number of multi-storey car parks buildings constructed in the City of Melbourne in the 1950s and 1960s in response to the massive rise in car ownership during the post-war period. In 1955 the City of Melbourne recommended that parking stations be established on every city block. The site of the future Total House was purchased in 1959-61 by the City of Melbourne and tenders for a new car park were advertised in 1962. The new building was designed by the architectural firm of Bogle & Banfield Associates, a partnership of Alan Bogle (1902-76) and Gordon Banfield (1922-2007). The developer of Total House was the Savoy Car Park Company, which was controlled by Gordon Banfield, who owned or developed many car parks and entertainment venues in the city in the 1960s and 1970s. The name of the building derived from one of the building's tenants, the French company Total Oil Products P/L (Australia), which occupied the whole of the tenth floor of the building from 1966 until at least the mid-1970s. Total House is one of the earliest examples in Victoria of the Brutalist style, which incorporated ideas of integrity in the expression of materials, structure, and function, and gave rise to dramatic building forms. Brutalism dominated construction in post-war Japan, and details of these buildings were widely published and admired by western architects: in Australia Robin Boyd published a monograph on Kenzo Tange in 1962. At this time many Australian architects visited Japan. The design of Total House shows a strong Japanese influence. In the basement of Total House was the luxuriously appointed Lido nightclub, the first of its kind in Victoria. Most of the shop fronts and the entry to the offices were altered in the 1980s or 1990s, with glass canopies added at this time.*



**Construction of new ball mill at Railton in Tasmania, 1970**

I was responsible for site supervision and contract administration of the project. I regularly flew with Ansett ANA airlines to Devonport from Essendon airport in a Fokker Friendship aircraft<sup>14</sup>, usually spending the night in a motel and driving a hire car down to Railton to inspect the works before flying back to Melbourne late afternoon. I can remember on one occasion, Essendon Airport was closed, so we were taken by bus to Mangalore airport, which until 1970 it was an alternative to Essendon Airport. It was about a 2 ½ hour drive north of Melbourne, and when we arrived at Mangalore at about midnight, that airport also was closed because of fog, so we returned to Melbourne, getting back in the early hours of the morning. After a few hours of sleep, I reported for work at 9 am in the office, to the surprise of everybody who thought I was in Tasmania.

Construction of the Ansett-ANA Aircraft Maintenance Base at Tullamarine Airport commenced about this year.

My gross salary for the year 1968/69 was £5,048. I cannot remember whether I got a bonus or not.

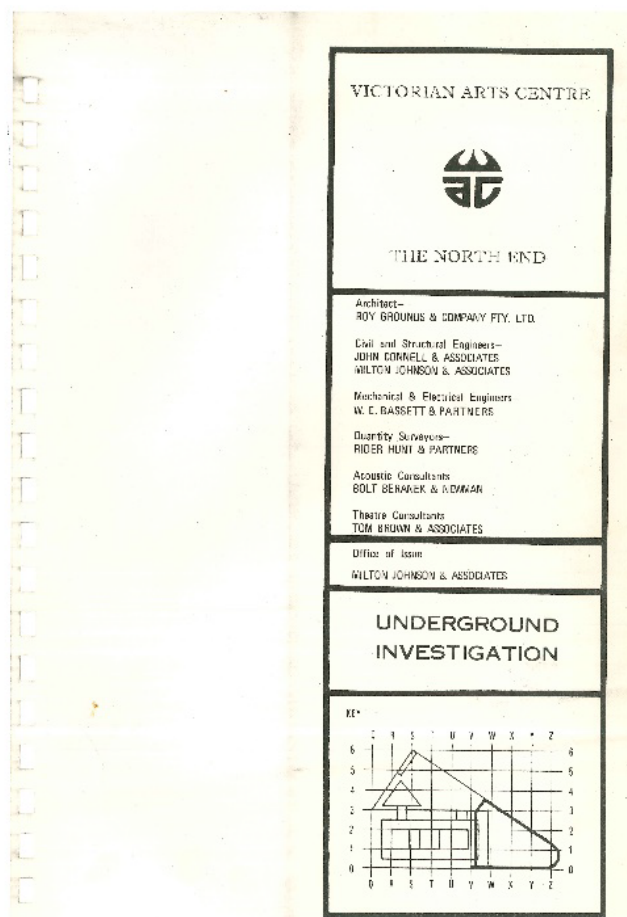
---

<sup>14</sup> The Fokker F27 Friendship is a turboprop airliner developed and manufactured by the Dutch aircraft manufacturer Fokker. It is the most numerous post-war aircraft manufactured in the Netherlands; the F27 was also one of the most successful European airliners of its era. It was flown by both TAA and Ansett.

## **1970**

In 1970 I also continued to work with Milton Johnson and Associates (MJA) as a graduate engineer on a variety of projects for the year. Our offices were at Total House, 180 Russell Street in Melbourne ph. 663 2233.

The office prepared a report on the underground investigation for the Victorian Arts Centre at the northern end for Roy Grounds and Company, who were the architects, and the structural and civil engineers were John Connell and Associates (JCA) and Milton Johnson and Associates (MJA). The report was prepared by MJA for JCA. I assisted Milton in editing the report, but most of the work was done by Milton Johnson. The investigation was split into four sections with perimeter drilling, caisson sinking, observation wells and testing, and the total cost of the geotechnical investigation was \$152,000. The report included 2 caissons which were 5'9" in diameter and 100 feet long in mild steel, sunk to the rock level 25 feet long sections and welded on-site to form a continuous tube. At the bottom of the tube, tests were carried out on the in situ Silurian rock. Soilmech carried out the testing in conjunction with Dr Jack Morgan from the Department of Civil Engineering at the University of Melbourne.

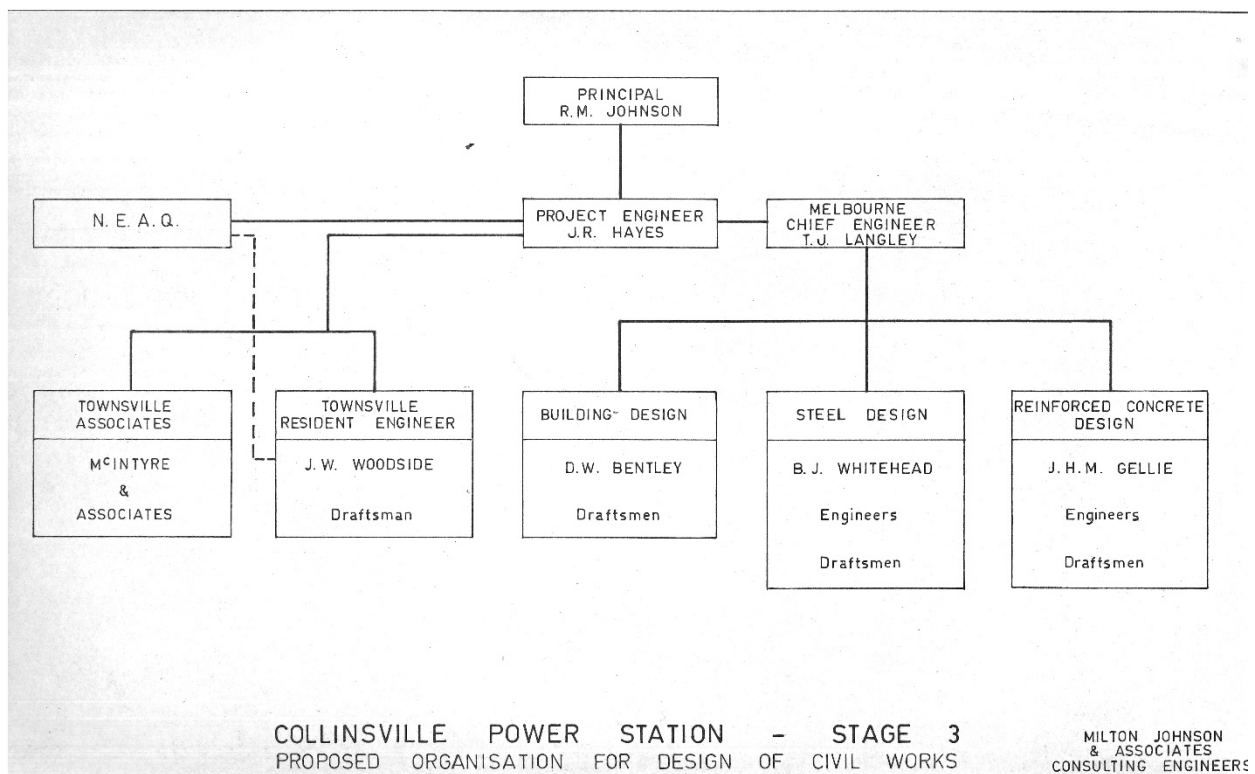


I was also involved in a prestressed design for a building in Singapore with a post tensioned floor arrangement. Another job I did was some proposed modifications to a kiln foundation at Goliath Cement in Tasmania.

On 1 May 1970, VSL ran a symposium on post tensioning in buildings in Melbourne and just about everybody who was a structural or civil engineer in Melbourne attended. There were about 280 people on the attendance list. The writer attended on behalf of Milton Johnson and Associates, and seven people from JCA also attended. By now, post tensioning was starting to be accepted as a suitable method of design in the appropriate situation for concrete structures.

In July 1970, MJA prepared a report on a bulk cement terminal at Oakley in Victoria for the Australian Portland cement Ltd. The report recommended concrete silos, and the project cost was approximately \$122,000. In this era, MJA provided cost estimates, although a quantity surveyor would normally be used today.

In 1970 the firm put together a proposal for the design of civil works for Stage 3 of the Collinsville Power Station. If the proposal was accepted, the firm intended to establish an office in Townsville staffed by an Associate and a permanent resident engineer, and I was nominated to be the resident engineer, although I do not think I was ever consulted on this, and I was unaware of this proposal. An association had been formed with McIntyre and Associates in Townsville, but we did not win the job, so, fortunately, I did not have to go to Townsville as I find tropical areas difficult to live in and 2 years in Darwin in my later career.



During this year, I did 3 PJs (private jobs), which in hindsight, probably was not a wise thing, but in those days, PJs were not an issue. I provided expert witness to Mallesons solicitors relating to an accident at Richmond Abattoirs on 27 February 1965 where the concrete contractor who was the Monier Pipe and Reinforced Concrete Company originally set up by Monash before the First World War and the failure of an epoxy floor. I also did the calculations for Arthur Bennett for his house as part of the Ormond Ski Club's involvement with EA Watts, and I prepared three drawings for submission to the Council.

On 6 April, MJA sent me to a basic course with GE to learn about basic programming. By now, computer programs for designing columns and moment distribution were starting to be available, but they were only through bureaus. MJA had access to a computer timesharing service, but it was not very effective.

I was involved in a project for BBR for the CPF board building in Singapore with the proposed post tensioning of the main support floors in May.

Another job I was involved in was foundations for a new 550 hp rod mill at Ardlethan Tin Mine in New

South Wales, which necessitated a visit to inspect the reinforcement in June or July of that year. I took the opportunity to visit my mother at Griffith, about 60 miles west of Ardlethan as well. The project was for Vickers Ruwolt and included the design of a heavy concrete slab, including a heavy foundation being 50' x 30' in the overall plan, and the foundation was approximately 20' x 20' of heavy concrete sections.

From July to November, I was involved in site inspections and contract administration for a 2 storey office block at Footscray in Victoria for Ansett Freight.

I also designed the footings and suspended floors for a residence for Mr and Mrs Ineson at Beaumaris, who I think were friends of Milton, and I think it was a private job for him.

Towards the end of the year, I prepared a construction network for Sunnycrust bakery at Clayton, where I inspected the building works on 18 December.



Ansett freight offices, Footscray, Melbourne

I was approached by a firm of personnel consultants, John R Waite and Associates, to apply for a couple of positions during the year, but I did not proceed with those as I was still learning as an apprentice engineer.

We used to play squash quite regularly amongst various other consultants in Melbourne as WP Brown, John Connell and Associates, and in September 1970, I was 3<sup>rd</sup> out of 7 on the squash ladder for MJP.

I well remember the West Gate Bridge Disaster of 15 October 1970. The failure spread rapidly around all offices, and we knew within an hour of the disaster occurring. It was almost like it was Christmas Eve, but it was not; very eerie, and everyone stopped working to discuss the failure. At 11.50 am on 15 October 1970, Australia's worst-ever workplace catastrophe occurred when a 367-ft (112 m) span of the West Gate Bridge, known as span 10–11 span of Melbourne's West Gate Bridge, collapsed during construction, killing 35 workers and seriously injuring 17 others. Approximately 2,000 tonnes of steel and concrete came crashing down into the muddy banks of the Yarra below, taking workers and their machinery, tools and sheds with them. Most victims were those working on top of the bridge at the time of the collapse. The bridge was idle for nearly 2 years and was eventually completed in 1978 and

nearly 8 years after the Royal Commission into the disaster found there were failures in the design, construction and management of the project. I have a copy of the Royal Commission Report, which makes sombre reading.

I was to discover in my later career that Steve Freeman, another engineer who I got to know very well in Adelaide in later years and who has become a close friend, was working on that project at that time, but he was not on site, fortunately.



**A picture of the bridge soon after the collapse**

Another project I was involved in was the modification to kiln No 4 at Goliath Portland Cement at Railton in Tasmania.



**Modifications to the Kiln footing at Geelong**

## **1971**

I worked for Milton Johnson and Associates and later became Milton Johnson and partners for most of the year before I resigned in October to go overseas.

Brian Whitehead, the Associate, had been sent over to Perth to open an office there, but I do not think it was a great success. I worked in Perth for January and February for MJA under Brian Whitehead on the civil works for a bulk unloading facility at Bunbury in Western Australia for mineral beach sands. The work included two piled raft slabs, receival hoppers, and reclaim tunnels. I lived at Westhaven House at 2 Eric Street, Cottesloe in Perth, near the OBH hotel, but without a car, it was difficult with not much to do on weekends. I used to go for a swim in the morning at Cottesloe before breakfast.

About this time, the firm changed its name from Milton Johnson and Associates (MJA) to Milton Johnson and Partners (MJP) and presumably, the partners had equity in the firm.



*The office at Total House about 1970 with John Hayes standing talking to John Woodside*

Work this year included the design of 2/1250 ton capacity cement silos supporter on an elevated podium slab with an associated elevator shaft and ancillary buildings in Melbourne and miscellaneous design for a cement mill in Queensland, including a slab on ground. Other work this year included the design of crane runway beams, tender design and drawings for a cement mill in Queensland and alteration to an existing factory and preliminary design for fermented tanks for Carlton United Brewery in Melbourne. Another job was structural framing for cranes and an engine overhaul workshop in Keilor Road in May.

MJP organised a squash championship held at the Toorak Station squash courts commencing on 27 April.

Milton Johnson also did some teaching at Melbourne University, and I was involved in a fourth-year civil

engineering design helping him. I cannot remember much detail, but we did set them an alternative prestressed concrete system for a high-rise building based on the preliminary design we prepared for a building in Singapore previously for BBR. On 10 February 1972, Dennis Ebbs, their accountant, wrote to me in London saying they had received a cheque of \$150.10 payable to me for lectures, but it was payable to MJP, which I accepted. I then had the cheque deposited in my account in Australia and drew a similar cheque to MJP.

A firm of Management Consultants approached me in 1971 to join John Connell and Associates (JCA). I was interviewed by John Connell, known as the *Silver Fox* staff to his staff behind his back and John Peyton, who was managing director, I think. I declined gracefully as I was going overseas, but of course, I was to work with them in later years.

In May, I was involved in preparing some structural framing for cranes at an engineering overhaul workshop at Keilor again for Vickers Ruwolt. Another project was some reinforced concrete floors for The Central Queensland Cement Company.

In July 1971, there was 32 staff in the office.

In June and July, I was involved in computer programming for soil mechanics using the GE timesharing library.

By way of repayment to EA Watts and, in particular, the efforts of Arthur Bennett in helping in the construction of the Ormond Ski Club, Arthur approached me to help him design footings and floor slabs for his holiday house at 14 Cairn Road, McRae, on the Mornington Peninsula. Arthur drew up the sketch plans of what he wanted and showed the materials, and I had to design the footings and suspended slabs. I designed the footings and floor slabs and drew a total of three drawings, including footing plans and suspended floor plans, together with a site plan and drainage between March and May 1971, and I still have the original drawings. The current price of the house is approximately \$1.8 million! I did remove the MJP titles, however, from the drawing sheet.

In September, I prepared some preliminary drawings for a fermenter seller at Carlton United Breweries (CUB) in Abbotsford, which would have been one of my last jobs.

On 6 October 1971, I resigned from Milton Johnson and Partners after nearly 4½ years' experience to go overseas to work for a year in the UK. But instead, I stayed for about four years in London, which is another story.

## **1972-1985**

I have limited knowledge of work carried out by the firm after this period after I left or when they ceased operating, although they were certainly operating in 1985 under a different name called MJ Consulting.

On 17 July 1972, Milton Johnson and Associates moved offices to 460 Swanson Street in Carlton, and the new telephone number was 347 144.

I returned to Australia in mid-1975 after nearly 4 years in the UK and joined John Connell and Associates (JCA) in 1976 in Melbourne and then transferred to the Adelaide office in July 1977.

From the information provided by Tim Langley in a letter dated 1 February 1985 to time, he advised that Brian Whitehead had left the firm in about 1975 and was living in Perth.

Presumably, after Milton Johnson retired in 1979, the firm changed the name of the firm to MJ Consulting Engineers Pty Ltd, and by 1985 they were still at 460 Swanson Street in Carlton, phone 03 347 7144.

In January 1985, I wrote to MJ Consulting Pty Ltd from JCA in Adelaide as I was applying to become a Fellow of IEAust and was to be married later that month. Tim Langley wrote me a friendly letter wishing me well for my impending marriage and said that John Hayes would fill in the form. I subsequently got a personal letter from John Hayes saying that he and his wife had separated, the children were grown up, and his interest had drifted away from engineering.

The Directors at that time were Tim Langley, John H M Gellie, John R Hayes, William D Ramsey, and Frank Pierce.

Some time later, Tim J Langley joined either John Connell and Associates (JCA) or Connell Wagner (CW) in Melbourne. In 1993 Tim moved to Darwin with CW as senior superintendent on the Apin project. Tim Langley retired as Connell Wagner's senior representative on the APIN on-site. In August 1996, he retired to Brisbane with his family.

## **Norman Henry Mussen (1909-1967)**

This information owes much to Judy Jackson and other members of Norman's family for the personal recollections and photographs published by the Australian Bridge Federation, which I have edited to suit, leaving out a lot of information on playing the card game, bridge. In addition, I have added some words from Built Heritage Pty Ltd on Norman Mussen <sup>15</sup> to supplement this section, and both sources are acknowledged.

In the period before World War Two, Norman Mussen was one of the greats of Victorian bridge in its heyday. He was born in Melbourne in 1909 to Gerald and Florence Mussen, younger brother to Gerry and Eileen.



**Norman Mussen**

The name of Norman's father –Sir Gerald Mussen – is not well-known these days, but he was an important figure in Australian finance, industry, and social and political thought over a thirty year period to the early 1950s. Born in New Zealand, he was a financial journalist and social theorist who promoted cooperation between employers and workers. In the period before the First World War Gerald, was an advisor to Broken Hill Associated Smelters Pty Ltd. In this position, he attracted much interest across Australia by promoting the construction of community facilities in cooperation with the trade unions.

During the 1920s, he played a similar role in Broken Hill in the development of miner welfare facilities and schemes. In later years he was a prominent and successful investor and company director. He was the main investor and driver behind the establishment of the Australian Paper Manufacturers pulp mill in Burnie in 1936, developed the early fish canning industry in Port Lincoln in 1937, and was President of the Federal and Victorian Citrus Association and a co-founder of the Adelaide News. He was knighted in 1939 and continued to publish his social theories in the 1950s.

Norman was sent to Wesley College aged about 8. Having never been in a church in his short life, he was soundly beaten by the headmaster on his first day of school for looking around during morning prayers. This unchristian act fortified the agnosticism subliminally instilled by his non-church going parents. He never became a believer.

---

<sup>15</sup> Built Heritage Pty Ltd, "Norman Mussen", *Dictionary of Unsung Architects*, [www.builtheritage.com](http://www.builtheritage.com).

After school, he started studying engineering at Melbourne University, finally completing his degree after what family history records as six years of championship tennis, bridge, chess, and riotous living.

Dame Zara Holt recalled in her autobiography that *"I was 16, and Norman Mussen was one of the several young men I was busily holding hands with. In spite of the Depression, he managed to be the proud possessor of a minute, broken-down bucket-seated Morris. One night he picked me up to take me to a dance at St. Mary's Hall, and although the car only held two people, we also picked up another girl and finally at the corner of Toorak and St Kilda Roads, a young man I hadn't met before, Harold Holt. He and Norman were at Melbourne University together, and somehow the four of us managed to pile ourselves into the car. Harold and I rather flamboyantly sitting on the hood at the back, me wearing Norman's top hat. Really and truly, men sometimes wore top hats in the evenings in those days, if they were wearing tails."*

The evening did not end so well for Norman as Zara dumped Norman for Harold, but there were no hard feelings and Harold was the best man at Norman's wedding, and he was a principal guest when Harold and Zara reunited and married in 1946. She recalls that Harold later told her that after that night, *"he had gone home very enchanted with her and decided I was pretty good and would do him for a few weeks"*.

Norman was one of Victoria's top tennis players, playing with the St Kilda club. In an era dominated by Harry Hopman, against whom Norman played on a number of occasions, he never won a state title but through the 1930s turned his attention more to doubles and won, with Miss M Cox, the Victorian mixed doubles championship in 1938.

Family history does not explain when or where he learned bridge. His older sister Eileen (Mrs I F Croft) was also a fine player and mainstay of the Victorian Women's teams, but family history is silent on whether the game was learned within the family. He certainly played at university, where the bridge scene was dominated by fellow students Hal Oddie, and Les Parker and the first record of his playing tournament bridge occurred in 1932 when he played with George Ewing (another long-term Victorian State representative).

Norman's peak years as a competitive bridge player were between 1937 and 1946.

The competition was suspended for the duration of the war. Norman was a member of the winning Victorian ANC team in 1946 (with Hal Oddie, Victor Champion, and Charles Hickman) but he was, for a number of reasons, not a prominent tournament player after that time. His health was part of the issue – he contracted TB in his thirties – but the larger factor was the development of his career in engineering and architecture.

We know nothing about Norman's early career other than it was a long time incubating. In 1936 his occupation was still listed as 'student' in the electoral roll. This seems to have been something of a family tradition as his sister Eileen, seven years older than he, was similarly still a student in 1936. (She married Ivan Croft and is recorded in later Victorian teams as Mrs I F Croft).

In 1936, Norman Mussen opened his own consulting engineering practice in Melbourne, with offices at 375 Collins Street, not far from his father's one in *Collins House* at 360 Collins St. The younger Mussen's early professional experience included working as a consultant engineer to architects such as Eric Beedham and Marcus Barlow; he was involved in the latter's design for the eleven-storey concrete-framed *Century Building* on Swanston Street. In 1940, soon after its completion, Mussen wrote to the editor of the *Argus* newspaper, arguing for the superiority of reinforced concrete over conventional steel framing and championing its use in defence projects. Fittingly, Mussen went on to act as consulting engineer to Percy Everett on the even more ambitious project for the new Russell Street Police Headquarters (1940-43).

In 1937 he married Ruth Russell, a fellow student and sometime tennis partner whose ambitions of a degree were cut short by the Depression and her father's financial losses. They remained devoted to each other until his death in 1967.

The Russell family's Toorak mansion and Macedon summer homes were important social centres for Melbourne, but the business was mortally wounded by the Depression. The business was finally wound up in 1936 after losing money for several years; the Toorak mansion was sold and part of the grounds sub-divided; and George Russell's antique collection, regarded as one of the finest in the country, was auctioned.

Once Norman entered the world of work, he seemed to have established himself very quickly. He wrote a letter written to the Argus in July 1940, beginning his passionate advocacy for innovation in building materials. He argued that the war necessitated a reform in building practices. In particular, too much steel that could be better used in munitions was being wasted in building frames. Reinforced concrete was cheaper and saved two thirds the weight of steel required for a steel frame.

He announced in that letter that he would not be practising his profession as a consulting engineer during the war. However, he was rejected by the army on account of his tuberculosis, and we do not know what he did do during those years. In 1945 he was listed with his father as a director of a new company – Electro Motors Proprietary Limited – and his occupation was listed as consulting engineer.

During the war years, Mussen moved his practice to *Collins House*<sup>16</sup> at 360 Collins Street, where his father still maintained his own offices. It was in this way that Mussen became involved in construction projects associated with Associated Pulp & Paper Mills Ltd, a consortium with which his father had been involved since its foundation in 1936.

Requiring the additional input of an architect, Mussen invited Keith Mackay to work with him, and in 1946, the two men merged their offices with a single address at 383 Latrobe Street. During 1950, they formally entered into a partnership, styled as Mussen & Mackay, architects and civil engineers.

Typically, in Melbourne fashion, names become intertwined with various firms, and in 1950 Milton Johnson joined the office of Mussen and Mackay, architects & engineers, as an engineer before he set up his firm Milton Johnson and Associates in about 1952. Within a year or so, the firm's name of Mussen & Mackay had been amended to acknowledge the admission of two more partners: architect Dennis Mirams (1904-1984) and engineer Charles Potter. The former was an Englishman who had spent fifteen years in the Far East, and the latter was a returned serviceman from Melbourne who had served with the 3rd Australian Survey Battery. However, the expanded firm of Mussen, Mackay, Mirams & Potter existed only very briefly during 1951-52; when Mirams left to open his own office, the remaining three partners continued to practise under the abridged name.

After the Second World War, he formed an architectural and engineering practice with Keith McKay and Charles Potter, starting with an office in his house before moving to Latrobe St. During this period, they were responsible for both the Boiler House, Australian Paper Mills (1954) and Hosies Hotel (1955), both much admired by architects today (who see them as fine examples of modernist buildings).

He lectured in structures at Melbourne University, studying architecture from which he never graduated as he was unable to sit for his own subject. For some reason, he was not awarded a credit. He also designed the spire of St Patrick's Cathedral, the Russell St Police Headquarters, and various other projects during these years.

During its earliest years, Mussen, Mackay & Potter maintained an informal association with the private practice of Roy Grounds (1905-1981), who, in his capacity as senior design tutor in the School of

---

<sup>16</sup> *The Origins and Development of the Collins House Group, 1915 -1951* Peter Richardson Economic History Department, The University of Melbourne, 1956 <https://nla.gov.au/nla.obj-495723208>

Architecture at Melbourne University, had invited Mussen to lecture in structural engineering in 1950. This association spilled into their respective private practices, and, in some contemporary sources, the firm of Mussen, Mackay & Potter was co-credited on two of Grounds' most important early post-war houses: the triangular Leyser House in Kew (1950-51) and the Ashton House in Mornington (1951-52). This direct connection with Grounds and the university allowed the office to take on some of the more brilliant students as staff, including Peter Hooks (1924-) and Don Hendry Fulton (1925-), who joined the firm, respectively, in 1952 and 1953.

Several of the firm's more interesting early commissions were outside Victoria. In 1952, the Northern Territory government engaged them to explore options for low-cost housing in Darwin; their report, published in 1954, provided a cost analysis for small dwellings of *pisé* (rammed earth) and aluminium construction. In April 1953, Mussen, Mackay & Potter was appointed as architects for the John Curtin School of Medical Research at the Australian National University in Canberra - a commission inherited from Professor Brian Lewis, who had been Consulting Architect to ANU since 1947. Engaged as Lewis' replacement, Mussen, Mackay & Potter opened an office in Canberra (at 13 Lonsdale Street, Braddon) and spent two years on the ANU project, which included not only the school itself but also associated buildings such as a workshop (1954), solvent store (1955) and boiler house (1955). Back in Melbourne, the firm designed another boiler house - for the Australian Pulp & Paper Mills at Fairfield - which, lauded as the first true curtain-walled building in Victoria, remains their best-known and most celebrated project.

Norman Mussen moved to Canberra in 1953 for the ANU project, decided to stay there and opened his own office as a consulting engineer. His erstwhile partners continued to practice in Melbourne as Mackay & Potter. Their output after Mussen's departure was marked by a swing towards larger commercial projects, including multi-storey city office buildings. In 1962, Potter embarked on a lengthy overseas study tour to study high-rise structural systems in the USA, Europe, and the UK. Mussen, meanwhile, became a much sought-after and successful consulting engineer in Canberra, working on major projects in that city and beyond. Amongst the noted architects with whom he worked were long-time colleague Roy Grounds (on the Victorian Arts Centre) and one-time employee Don Hendry Fulton (on the BP oil refinery building at Crib Point). Mussen, who suffered poor health for much of his adult life, died on 29 April 1967. In a published reminiscence, Melbourne architect Peter Corrigan recalled a time when, as a young man, he flew to Canberra, in the company of Roy Grounds, to attend the funeral of the "brilliant, romantic and chain-smoking engineer, Norman Mussen". Mussen's two former partners, Mackay and Potter, outlived him by three decades, dying, respectively, in 1997 and 1999.

Awarded the job of designing and building the John Curtin School of Medical Research in Canberra, Norman and Ruth moved to Canberra in 1953. He was hired to replace Melbourne's Head of Architecture, Brian Lewis (who set a precedent by being sacked) and found a huge H shaped hole in the ground as a basis for the design.

Bridge was out of his life, and dealing with academics proved a more tactical, challenging, competitive and complex task. The biography of Howard Florey, the driving force behind the school, recorded that Norman's appearance on the scene made a major difference, but at some stage, he also was sacked but continued to work on the enormous project, which was then nominally headed by his erstwhile employee John Scollay.

He was the engineer for the first stage of the Melbourne Art Gallery and Cultural Centre, working with Roy Grounds and with his former student, Roy's stepson Hamish Ramsay. His daughter recalls that *"they were exciting times in Victorian architecture with Roy Grounds, Frederick Romberg and Robin Boyd"*<sup>17</sup>

---

<sup>17</sup> When Grounds, Frederick Romberg and Robin Boyd formed their partnership in 1953, they were all well established architects in Victoria. Each brought considerable work to the practice, which they usually worked on separately, and the firm became successful. Grounds' first large commission was for the Australian Academy of Science in Canberra. The construction of its reinforced concrete dome was a considerable technical achievement. Opened in 1959, it won the Meritorious Architecture Award of the Canberra Area Committee of the

*among the innovative thinkers of the era. Everyone knew everyone, and his professional life was very exciting."*

During this time, he continued to be a fine writer and proselytiser for change in his architecture and engineering. He appears again in an article in the Age in May 1951, pressing the obvious but so often ignored importance of siting of a house in the design phase. He argued that "correct siting of the house is the first essential. It does not cost a penny more to site the house on the block so that any view is caught by the right rooms; any sun is caught at the right times; so that the summer breezes are welcomed, and the winter winds screened; and so on. Every house should be judged on these grounds. But where do most people site their house? Twenty five feet back from the street, main rooms to the front, regardless."

His primary concern was that he felt that the profession of architecture had taken a wrong turn. In 1952 in a series of lectures at Melbourne University, he began with the statement that *"ours is not a great age of architecture, and I think we all wonder why this should be"*. To Norman, the answer lay mainly in the way that architecture had separated from engineering. He pointed out, *"until the beginning of the 19th century, the architect did all the job himself and was generally the builder as well. He decided the thickness of walls, the size of beams and posts, the construction of arches and domes – he understood all the trades and crafts – he was appreciative of beauty. Wren was an example of this sort of architect."*

During the previous century, though, the architecture profession had become a closed shop and separated itself from the engineers, and now all emphasis was on the external look rather than the entire building as a work of art. *"For man has senses other than his eyes. The scent of flowers wafting in through a window, a feeling of snugness around a fire, are quite as relevant to architectural vision as combinations of colours or textures. and it goes deeper than this, for there is something even less tangible. a consequence of men who knew how to build something they loved for something they believed in. I feel that these things have been forgotten in an urge to the photogenic."*

He never did manage to tackle the closed shop of architecture or call himself an architect. He studied architecture while teaching in the architecture faculty but never graduated as he was unable to sit for his own subject. Nevertheless, tributes from former students make it clear he was an inspiring teacher who opened new frontiers for a new generation of architects. He had the great teacher's ability to make everyone feel interesting and worthwhile, and his students (now in their 70s) from his days as a lecturer were still delighted to meet the family and reminisce about him.

Kevin Borland in his book *"Architecture from The Heart"* paid particular tribute to Norman's contribution to his success, including the Olympic Swimming Pool in Melbourne. He wrote that Norman "had a completely different approach to teaching theory of structures, having us analyse the stresses in buildings rather than just using set formulae to design columns, beams and slabs. He also introduced us to the new construction of pre-tensioned and post-tensioned concrete. The lessons were crucial to their winning the competition for the 1956 Olympic Swimming Centre. Because of the continuing post-war shortage of materials (which created criticism that building for the Olympics was taking away much-needed materials from housing), the competition rules stressed the importance of finding ways to reduce the amount of materials in the building. Norman's theories which reduced the need for material by balancing forces, were the basis of their winning design.

Norman had effectively given up bridge when he moved to Canberra but started to play socially again when his daughter Judy returned to Canberra from overseas. She recalls that *"I had spent time overseas,*

---

*Royal Australian Institute of Architects (RAIA) and the Sulman Award for Architectural Merit. The Academy building also led to other work in Canberra, initially for the firm and later for Grounds himself. In 1959 the firm was awarded the commission to design the National Gallery of Victoria and Arts Centre, with Grounds named in the contract as the architect in charge. When Boyd and Romberg were mildly critical of the preliminary geometric designs that Grounds showed them, relations between the partners became strained, and in 1962 Grounds left the partnership, taking the commission with him.*

*learning a simple form of bridge in Canada. On my return to Canberra, Dad was delighted to have an opportunity to take up the game again. Poor man. He and my mother played against my about-to-be husband and me. We all played appallingly"* He devised and taught them a system whereby one's first bid at the 2 or 3 levels indicated a shortage and which Norman's daughter Judy and her husband recall using to great effect in beating the Far East Bridge Champions while they lived in Taiwan for a couple of years.

Norman and Ruth also played regularly with great friends John and Betty Gorton, who Judy remembers as *"being as bad as the rest of us."* John Treglown's biography of John Gorton tells us that back in the late 1930's *"the Gortons' closest friends then were Ruth and Norman Mussen. Ruth was a long-time friend of the Gorton family (she first met John Gorton when she was 14 and he was staying at their house with her brother). Her husband Norman, a structural engineer, was like John, a very competitive man, and they formed a spontaneous antipathy to one another on their first introduction. Gradually, however, they became warm friends, though they never ceased vying with each other in almost every activity."* These activities included tennis, table tennis, a self-invented combination of 'ping pong golf' and finally Morse code that John Gorton was required to learn this prior to entering the air force. When Gorton was recovering from his war injuries, part of the rehabilitation was races with Norman down the drive of their property on pogo sticks.

It should be noted that, for people who had an above average number of Prime Ministers for personal friends, Ruth and Norman did not have strong political interests. The only reference to Norman's involvement in politics comes from a report on a rowdy but good natured meeting during his student days involving a visiting professor talking about communism. The report noted that after the meeting, the national anthem was sung by a section of the crowd led by "a Norman Mussen".

Despite his TB, he remained a devoted smoker. In the late fifties, his health deteriorated, and he developed emphysema. He felt terrible most of the time but, Judy recalls, *"was much cheered by my brother's and my contemporaries, who loved him and visited him for intense discussions of everything and anything"*. He died on 29 April 1967.